MODERN PLASTICS

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JULY 1951

MODERN PLASTICS*

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VOLUME 28 JULY 1951 NUMBER 11

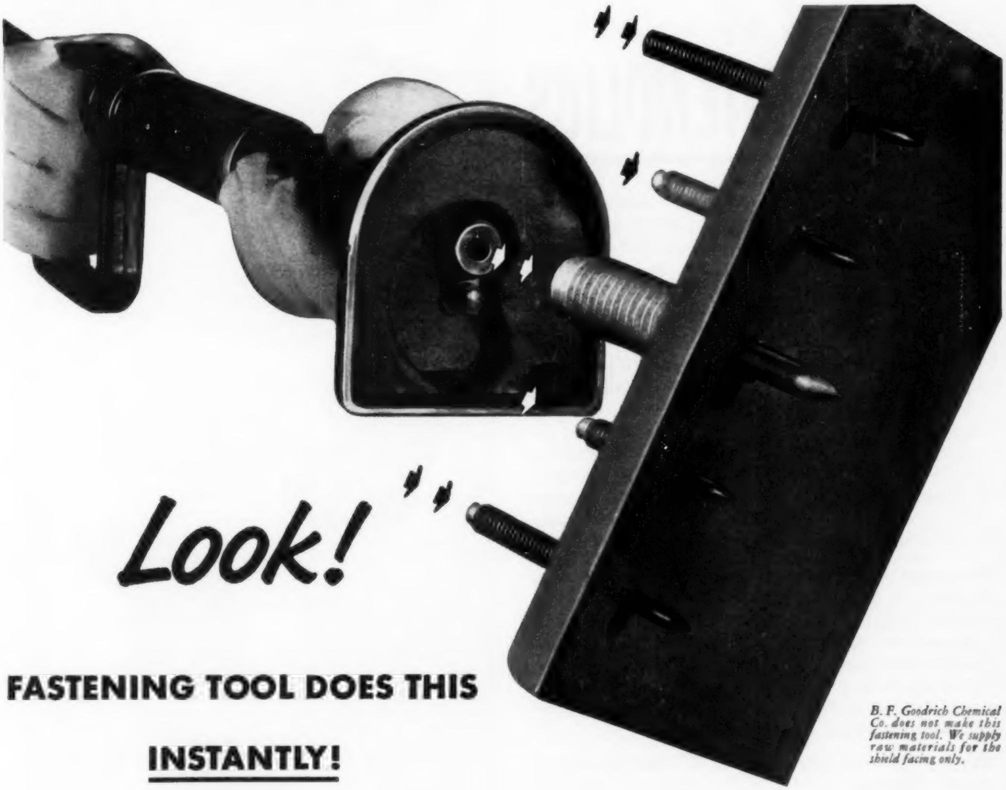
CONTENTS

Modern Plastics, published monthly by Modern Plastics, Inc. at Emmett St., Bristol, Conn. Executive and Editorial Office: 575 Madison Ave. New York 22, N. Y. Published each month by Modern Plastics, Inc. Entered as second class matter at the Post Office at Bristol, Conn., December 14, 1950, under the act of March 3, 1879.

Subscription $5.00 a year, $8.00 for two years in the U. S., its possessions, and South America. Canadian subscription $5.00 a year, $8.00 for two years. All other countries $5.00 a year, $8.00 for two years, payable in U. S. currency. Price of this issue 75 cents per copy. Printed in the U.S.A. by the Hildreth Press, Inc., Bristol, Connecticut.

Another new development using

B. F. Goodrich Chemical Company *raw materials*



FASTENING TOOL DOES THIS

INSTANTLY!

B. F. Goodrich Chemical Co. does not make this fastening tool. We supply raw materials for the shield facing only.

Uses Geon for safety shield

YOU'VE never used anything like it! This tool drives fasteners into steel, concrete or other tough materials—fastens them together securely, *instantly!*

The fastener and powder charge are inserted in the barrel. A turn of the tool handle actuates the powder . . . the compressed gases drive the fastener with a powerful thrust. You can see how vital the Geon-faced shield is to proper operation of the tool.

The shield, faced with a ¼-inch layer of Geon, catches "spall"—flaking particles of concrete, brick, etc. It softens noise of the powder action. And Geon resists effects of the powder gases . . . resists grease, helps prevent it entering the tool . . . resists abrasion. Tests show the Geon shield will ordinarily last for 6 to 7 years.

Geon materials have advantages that are ideal for improving or developing products, for both civilian and defense uses. Geon resists heat and cold, water, weather and wear, oil, many chemicals. Demand now exceeds supply, but limited quantities are available for development work. For technical advice, please write Dept. GA-7, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

Geon
Polyvinyl Materials

GEON RESINS • GOOD-RITE PLASTICIZERS . . . the ideal team to make products easier, better and more saleable.

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON organic colors

EDITORIAL

This Industry Must Keep On Selling!

At the end of March, inventories of manufacturers, wholesalers, and retailers were the highest on record. That's official. Spot checks at all levels of distribution late in May indicate that inventories have increased since the end of March.

There are several reasons. First, government threats of cutbacks on raw materials early in 1951 led manufacturers to produce at unheard-of speed while waiting for defense orders which are still light and slow in coming. Second, the distributive trades, encouraged by the year-end consumer buying wave, advanced orders, then found them filled too fast for comfort. Scare buying by the public stopped, but backlog orders kept filling inventories. In March, according to the Department of Commerce, manufacturers' new business was bigger than their deliveries by $4,700,000,000. Third, credit restrictions and upped prices cut sales in durable goods, automobiles, and housing. The aforementioned stoppage of scare buying plus big increases in the cost of food cut sales in most soft goods.

The most conservative economists believe that it will take from three to five months to bring retail inventories into balance again—longer to accomplish it in manufacturers' made-up stocks. Meanwhile, the public will not be frightened into buying and will be less likely to buy in the face of scheduled income tax increases. Credit restrictions will continue in force. Defense orders will be stepped up—but how fast and in what volume nobody knows. Furthermore, each manufacturer will be affected by defense business to a different degree and at a different time. No pattern has yet appeared in which the future can be traced.

What to do? If a manufacturer cuts production to let slow sales remove inventories, he'll lose trained workers that he is sure to need later when defense orders start rolling. His bankers wouldn't appreciate that attitude, either. His working capital will need to be replenished somehow if he is to bring out new models. Indeed, the average manufacturer is going to need more working capital if he is to do a proper job on defense work. Inventories must be shortened!

What to do? The only thing that will cut inventories soundly, the only thing that will keep money liquid, the only thing that will keep business ready for a prosperous peace, a military stalemate, or total war, the only thing that will keep skills available, is SELLING.

Advertising, promotion, and selling effort can make all the difference in the next few months. Selling can bring in cash to maintain the flow of materials to plants, to maintain payroll balance, to finance development on new jobs, whether civilian or defense applications. Selling can keep machines running and can keep men employed who will be needed in the future, regardless of international developments.

The main project now, and at least for the rest of this year, to bring into balance the presently absurd inventory picture is—selling.

THIS INDUSTRY MUST KEEP ON SELLING!

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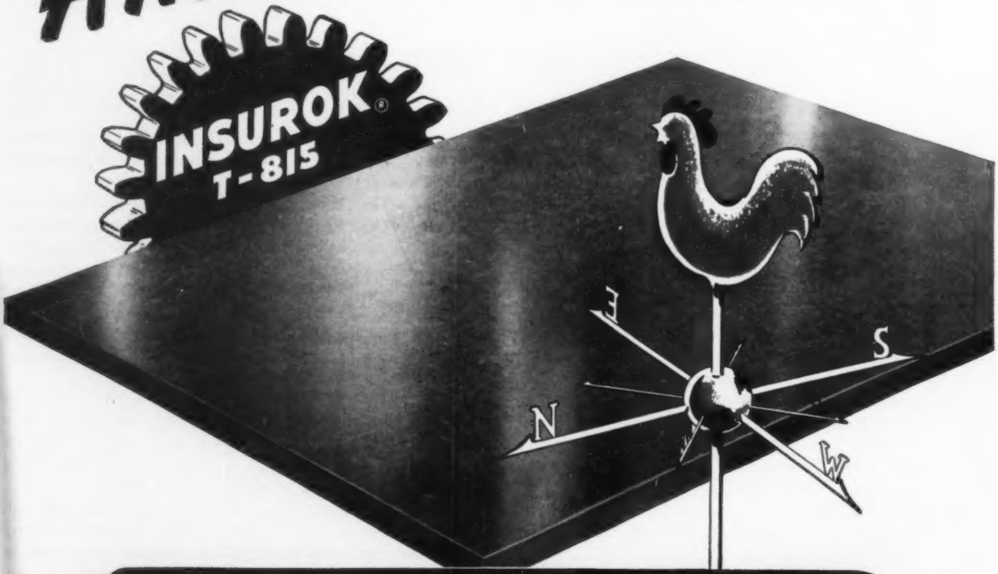
A New REINFORCED LAMINATE
For Gears and Mechanical Parts



Provides UNIFORM STRENGTH IN *ALL** DIRECTIONS

Plus . . . Smooth Mechanical Finish . . . Good Electrical Properties

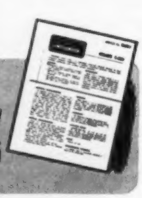
Its reinforcement is different! . . . that's why this new material provides such a unique combination of properties.

Instead of woven fabric, new INSUROK T-815 is reinforced with unwoven cotton fibres, random-laid in the form of a mat. Thus, it exhibits high uniform strength—in the main direction, cross direction, and *all intermediate angles!* This property is valuable in gears and other mechanical components, where teeth or other sections must have equal strength.

But Grade T-815 has more than uniform strength. Its electrical properties are good, and it machines well to smooth, clean surfaces, with finish and texture superior to any cotton fabric-base laminate made. Furthermore, T-815 can be punched—hot or cold, depending upon the thickness—making it valuable for thin electrical parts requiring high strength.

Investigate new INSUROK T-815 for your product, today.

SEND for new **Data Sheet T-815**



**All directions in the plane of the sheet*

The RICHARDSON COMPANY

FOUNDED 1858—LOCKLAND, OHIO

2789 Lake St., Melrose Park, Illinois (Chicago District)

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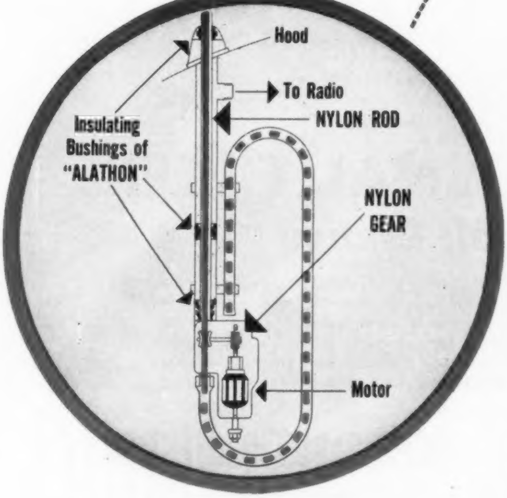
Du Pont NYLON plastic drives new automatic antenna



When driver pushes button, motor-driven worm gear turns nylon gears, which turn spring-loaded pulleys. Nylon rod is driven up by pulleys, forcing "live" members upward. Rod coils into trombone-like shape (dotted line) when antenna is lowered. Insulating bushings are made of Du Pont "Alathon"* polythene resin, an outstanding high-frequency insulating material. *TRADE-MARK

Only nylon meets mechanical and electrical requirements for Packard antenna

When the Casco Products Corp., Bridgeport, Conn., designed this new motor-driven antenna for Packard automobiles, plans called for a 4½-foot flexible rod to raise and lower "live" members. This strip had to have an unusual combination of properties. Most important of these: it had to be rigid enough to force the antenna up and down, yet flexible enough to fold into a trombone-like position when the antenna is down; and the rod had to have good dielectric properties.

Only Du Pont nylon plastic was found to have all of the properties required. The nylon driving rod has excellent mechanical strength and very low deformation under load, yet is flexible even at extremely low temperatures. The curvature in the trombone-like position has a 4-inch radius, and the nylon rod, while rigid enough to raise and lower the antenna, still takes sharp curves easily. And nylon's electrical properties meet the requirements of the application.

In addition, two nylon gears engage a steel worm gear which is an extension of the armature shaft. They're molded directly onto the shafts to which driving pulleys are attached. The nylon gears are quiet and long-lasting. Both rod and gears have been subjected to as many as 80,000 cycles—many times more than they could possibly be called on to withstand during the life of any car. Neither shows any sign of wear.

Versatile nylon plastic may help *you* develop a better product or process. Demand for nylon currently exceeds supply. However, we suggest you investigate the properties of nylon for future application. We will gladly discuss the availability of quantities for development work. For additional information on nylon and other Du Pont plastics, write:

E. I. du Pont de Nemours & Co. (Inc.),
Polychemicals Department, District Offices:
350 Fifth Avenue, New York 1, New York
7 South Dearborn Street, Chicago 3, Illinois
845 East 60th Street, Los Angeles 1, California

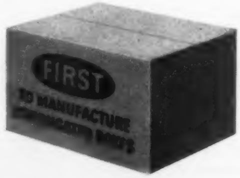
DU PONT
PLASTICS
Better Things for Better Living
. . . through Chemistry

This precision food and beverage mixer gets precision protection in shipment!

Even the finest appliance is useless, unless it is delivered to the customer *in good condition.* And to make sure the Waring Blendor arrives in perfect condition, the makers of this famous food and beverage mixer ship it in this H & D engineered shipping box. Die-cut supports hold the mixer securely in place, guarding it against jolts and bumps in transit.

The H & D Package Laboratory is ready to help with any shipping problem, to provide extra protection, or to give better display . . . increased sales . . . lower shipping and packing costs. For booklet, "Package Engineering," write Hinde & Dauch, 5104 Decatur St., Sandusky, Ohio.

H&D®



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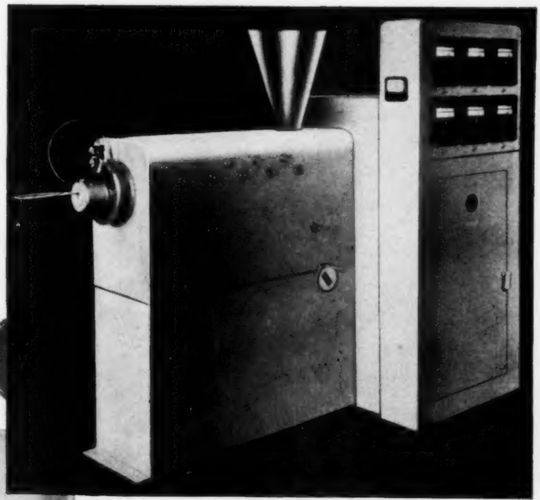
mpm EXTRUDERS

made in the capacity you need



The popular MPM 2½" thermoplastic extruder

present and *anticipated* requirements should be taken into consideration when deciding which size extruder to buy. Because of the rapidly expanding markets for extruded products, many extrusion machines which were adequate when purchased, must now be supplemented in order to meet production schedules.

In the range of MPM extruders (1½", 2", 2½", 3½", 4½" and 6") there is a machine that will match your needs. These extruders, which are in use in twenty-two countries outside of the United States, extrude all manner of thermoplastic materials, including nylon, Kel-F, Formvar and methacrylate.

Every MPM extruder, regardless of size, has these important features:

(1) all vital parts made of solid (not plated) materials.
(2) nine to fifteen individually jacketed cooling zones, depending on machine size.
(3) internally heated or cooled screws.
(4) safety die-head of improved design.

In addition to providing extruders which can be depended upon for day after day close tolerance output, MPM manufactures a full selection of equipment that includes dies, conveyors, capstans, film take-ups, monofilament orienting units and nearly everything else in the machinery line that's needed for high-production operation.

Consult MPM for considered recommendations of a suitable extruder for your current and contemplated needs.

California Representative:
WEST COAST PLASTICS DISTRIBUTORS, INC.
2325 Jesse Street, Los Angeles 23, Cal.

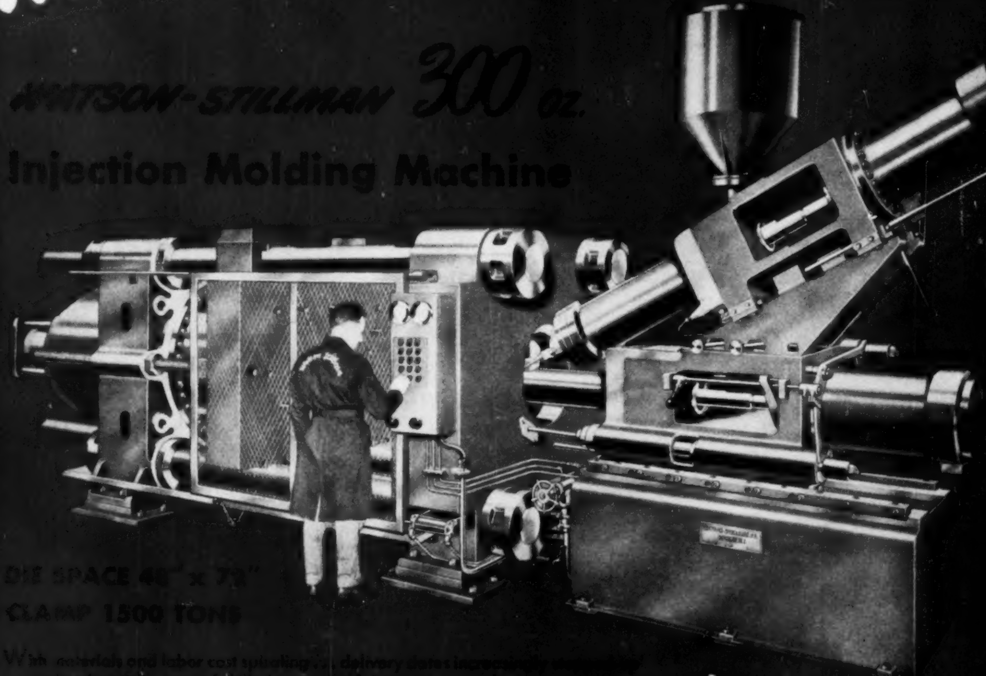
15 Union St., Lodi, N. J., U. S. A.
Cable Address: MODPLASEX

In times like these...

IT'S THE EXTRAS THAT COUNT

WATSON-STILLMAN 300 oz.

Injection Molding Machine



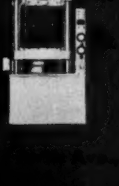
DIE SPACE 48" x 72"

CLAMP 1500 TONS

With materials and labor cost spiraling . . . delivery dates increasingly [illegible] . . . an imminent shortage of skilled operating labor—it is more than ever [illegible] for PLASTIC MOLDERS to know *all* their suppliers . . . and everything [illegible] has to offer.

As THE pioneer and fifty-two-year consistent leader in the design and [illegible] of Plastics Molding Machinery, W-S is in an especially good [illegible] molders of every size and type a *complete* service. Not only the [illegible] extensive line of molding machinery [illegible] available . . . but [illegible] in the form of engineering counsel on [illegible], die-design, and plant layout.

In times like these, such extra service, extra attention to every vital [illegible] operation is increasingly valuable. Because of its machine [illegible] 300 ounces, and the broadest range of injection, compression and [illegible] molding machines, W-S is your logical consultant on any project [illegible] And once you have enjoyed the advantages of COMPLETELINE [illegible] ing far beyond equipment needs alone—you will always [illegible] molding equipment and how to use it.



WATSON-STILLMAN

HYDRAULIC MACHINERY DIVISION [illegible]

Main Office, 150 Aldene Rd., Roselle, New Jersey

Branch Office: 228 No. La Salle St., Chicago, [illegible]

Manufactured in Canada by—Canadian Vickers, Ltd., [illegible]

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[illegible]

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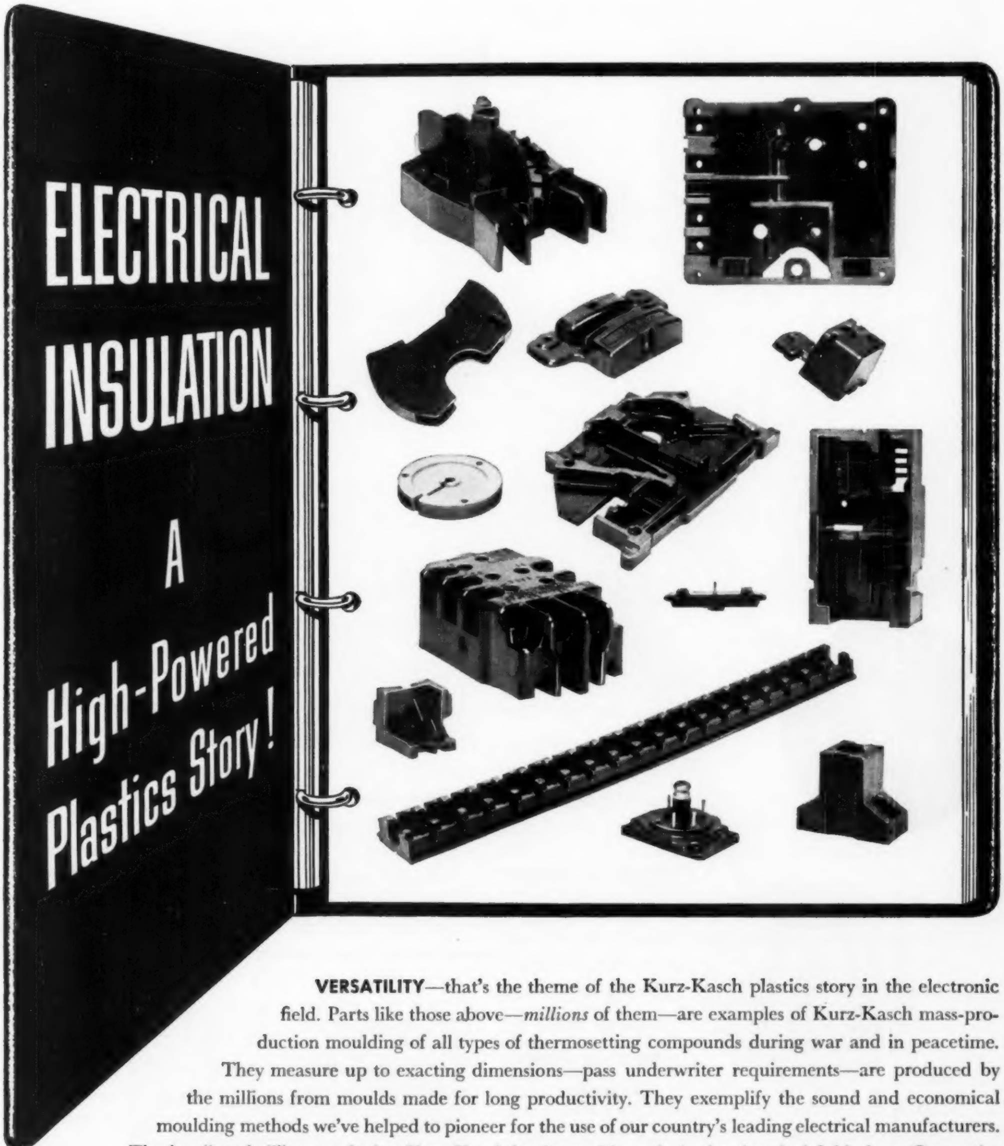
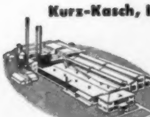
W-S "COMPLETELINE"—SHORTEST DISTANCE FROM PRODUCTION TO PROFIT



VERSATILITY—that's the theme of the Kurz-Kasch plastics story in the electronic field. Parts like those above—*millions* of them—are examples of Kurz-Kasch mass-production moulding of all types of thermosetting compounds during war and in peacetime. They measure up to exacting dimensions—pass underwriter requirements—are produced by the millions from moulds made for long productivity. They exemplify the sound and economical moulding methods we've helped to pioneer for the use of our country's leading electrical manufacturers. That's a "nutshell" story of what Kurz-Kasch has been able to do in the electrical field alone. Our entire output, of course, goes further—to a complete cross-section of American industry. Maybe we can help *you*. You can find out by telephone.

Kurz-Kasch, Inc. • 1415 South Broadway • Dayton 1, Ohio



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Kurz-Kasch

FOR OVER 35 YEARS PLANNERS AND MOULDERS IN PLASTICS

Automatic Molding cuts costs for Electric Steam Radiator

These fully automatic molding presses have operated 24 hours a day ever since they were installed. The only work required is filling hoppers and removing finished parts.

New production figures of the Electresteem vaporizer and the Baby Chef Jr. bottle warmer are gratifying to both executive and shop levels of Electric Steam Radiator Corporation, Paris, Ky.

In the re-designed form—plastics replacing porcelain—the product is generally superior: more durable, lighter, easier to handle, and with less external heat loss.

If you want to know what automatic molding can save you in production costs, send parts or blueprints for a free analysis and report by Stokes engineers.

STOKES MAKES Automatic and Semi-Automatic Molding Presses, Plunger Presses, Closure Presses, Preforming Presses, Industrial Tabletting and Powder Metal Presses, Vacuum and Special Processing Equipment, Water Stills and Special Machinery.

STOKES

F. J. STOKES MACHINE COMPANY, 5934 TABOR ROAD, PHILADELPHIA 20, PA.

CUTTING PAD *used to back up clicking machine shown above operated for 8 months. Close-up shows lack of effect on* PLIO-TUF *of severe impact repeated thousands of times.*

UNDER the cutting knife of a clicking machine, this PLIO-TUF pad you see has been taking constant blows from the sharp blade for over 8 months—6 three-shift days a week. Yet after many thousands of cuts, the pad shows relatively little wear and no evidence of chipping or dusting. Even the few signs of this hard service can be easily removed, because the thermoplastic PLIO-TUF can be resurfaced by a simple re-pressing operation.

PLIO-TUF can be compounded from Goodyear's PLIOLITE S-6 or S-6C and the rubber of your choice. And you'll find that PLIO-TUF gives you all these advantages:

Hardness and rigidity — can be machined or molded to shape • Impact resistance—will not break under repeated impacts • Non-chipping, non-dusting—insures clean surfaces • Resists moisture—will retain shape desired • Light color • Thermoplasticity • Light weight • Chemically resistant • Flexibility of physical characteristics

PLIO-TUF is in use in protective equipment, textile spool ends, chemical pipe and container manufacture, carrying cases and tote boxes, in sporting goods—wherever impact resistance and other properties above are important. It will fit into your production plans, too.

Although the PLIOLITE S-6 resins are currently in short supply, start your laboratory work now as normal availability will return.

Write today for full details and samples for your own appraisal to:

Goodyear, Chemical Division, Akron 16, Ohio

GOODYEAR

Plio-Tuf, Pliolite—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

INJECTION MACHINES

Ideal operates nearly one hundred injection molding presses (and many more are coming). There are three, four, six, eight, twelve, sixteen, twenty, twenty-four, thirty-two, forty-eight, sixty, two hundred and three hundred ounce presses and all the spare parts needed to keep each of them running at top efficiency 100% of the time.

MOLD CONSTRUCTION

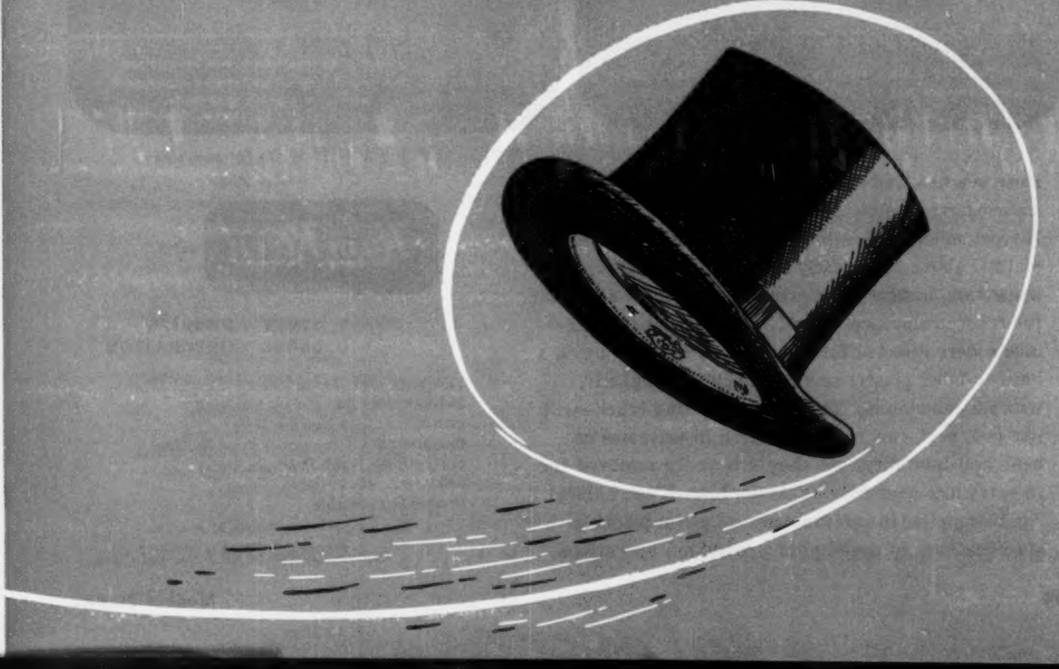
The plant's two magnificently equipped toolrooms have every machine needed to build any injection mold, regardless of size or complexity... lathes, three-dimensional duplicators, milling machines, a jig borer, grinders, hobbing presses. Mold repairs and even major presses repairs can be handled right in the plant and without delay.

FINISHING FACILITIES

Assembly tables, enormous amounts of clamping and gluing equipment, electronic and needle sewing machines, spray booths, an electroforming department, arbor presses, drill presses, and the trained personnel to operate all of them. There's full equipment for assembly, inspection, testing and packing anything that can be manufactured by injection molding.

ENGINEERING

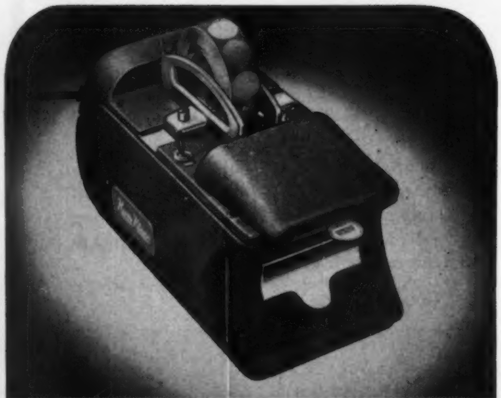
At Ideal you will find an experienced, production-wise staff of product developers who know what good design is and who know how to incorporate it into the products they are responsible for. Available for them to work with are a large model shop and a complete laboratory for testing and checking materials and products during every stage of design and manufacture.



informative labeling in inspection!

Helipot units start through production with application of Kum-Kleen Labels, selected because they stick to difficult-to-label plastic surfaces.

Assembly and testing steps are recorded on label, which is easily peeled off and filed for future reference.



Kum-Kleen pressure-sensitive labels can be applied at production-line speed free of expensive equipment investment, with new electric dispenser.

Here is a new and excellent example of Kum-Kleen informative labeling in inspection. According to Helipot officials, South Pasadena, California, the method above has greatly increased speed and inspection accuracy and provided records of each unit for future reference. Kum-Kleen pressure-sensitive labels were selected for their ease of application on a hard-to-label plastic surface. They are applied without moistening. They stick-and-stay-stuck—will not pop, peel, curl or rub off, even in extremes of heat and humidity, yet they are easily removed for re-entry into record books. Avery Kum-Kleen Labels can be supplied in various sizes, shapes or printing specifications to speed *your* production operations.

Write for samples and prices

Kum-Kleen

AVERY ADHESIVE LABEL CORPORATION

NEW YORK CITY: 41 Park Row
DETROIT: 3049 East Grand Boulevard
CLEVELAND: 2123 East 9th Street
PHILADELPHIA: Commercial Trust Building
CHICAGO: 608 South Dearborn Street
CINCINNATI: 626 Broadway Street
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Representatives In All Principal Cities

full benefit of the ~~old~~ new ONE-TWO!

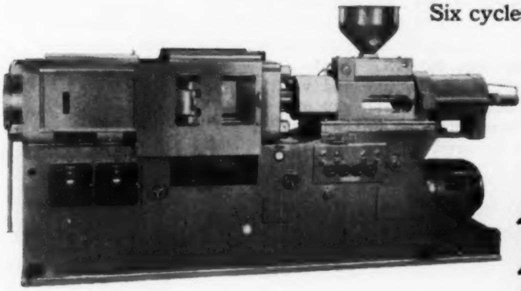
Sharp, fast set-up... then the close-in power punch...

that's the essence of Fellows speed-cycle improvement.

The Fellows two-speed injection plunger... rapid advance, then peak power... is ideal with pin-point gating.

Six cycles per min. (dry-run) on the 5C-8!

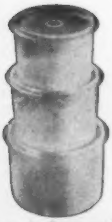
Better look at Fellows first.



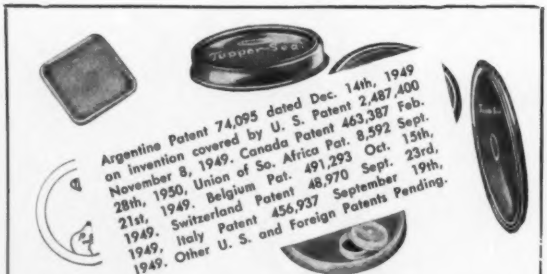
Fellows
LEOMINSTER

injection molding equipment

THE FELLOWS GEAR SHAPER CO., Plastics Machine Div., Head Office & Export Dept., Springfield, Vt. Branch Offices: 616 Fisher Bldg., Detroit 2. 5835 West North Avenue, Chicago 39 • 2206 Empire State Bldg., New York 1 • New England Distributor: Leominster Tool Co., Leominster, Mass.



Tupper Seal, air and liquid tight flexible covers fit, and are included in the sets of all Tupperware Canisters.



There's a Tupper Seal, air and liquid-tight flexible cover for Tupperware 2, 5, 8 and 12½ oz. Tumblers too, and these Tupper Seal, covers fit many other containers of metal, glass and crockery.

TUPPER! Seals

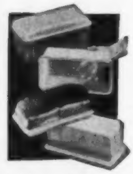
air and liquid-tight, flexible covers for Tupperware Tumblers, Canisters, Wonder Bowls, Cereal Bowls and many another container of glass, metal and pottery, the contents of which it is desired to keep fresh and wholesome.

TUPPER!

The Tupper Seal, air and liquid-tight flexible Par Top cover, specially designed as a dispensing cover for specified diameters of containers holding foods such as syrups, salad dressings, catsup.

The Tupperware 50 oz. Canister is "standard equipped" with the Tupper Seal, air and liquid-tight flexible Pour All cover.

The Tupper Seal, air and liquid-tight flexible Pour All cover is used on every Tupperware 20 oz. Canister.



The cover of the Tupperware Bread Server which serves as a bread tray also is designed to give similar results as Tupper Seal, air and liquid-tight Flexible covers. Keeps contents fresh as no other such container.

FORMAL NOTICE! 9th November, 1949

EXCLUSIVE!

U. S. Patent #2,487,400

The Tupper Corporation has attained a position of leadership in this industry by incurring great expense and expending painstaking effort in the development, design, manufacture and exploitation of its many world-known products.

The Tupper Corporation further has anticipated the inevitable attacks to which leadership is subject and has taken measures provided by law to preserve the creative rights to its products, methods and design by patent protection both in the United States and abroad.

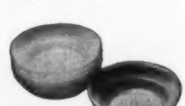
Tupper Seals for Tupperware shown in this advertisement are just a few of the forms covered in this manner and are specifically covered by U.S. Patent #2,487,400.

Only the Tupper Corporation, by U.S.Patent #2,487,400 has the right to make, use and vend container closures in connection with any and all types of containers throughout the United States and its territories as covered by the claims of the Patent.

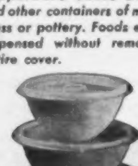
Tupper Corporation will protect, according to law, the exclusive rights above granted

TUPPER CORPORATION

The Tupper Seal, air and liquid-tight, Pour All cover as a cover for 46 oz. cans; Tupperware Sauce Dishes and other containers of metal, glass or pottery. Foods easily dispensed without removing entire cover.



When equipped with Tupper Seal, air and liquid-tight, flexible covers, Tupperware Cereal Bowls serve many another purpose.



The Tupperware Wonder Bowls are usually fitted with Tupper Seal, air and liquid-tight covers.

The Tupper Seal, air and liquid-tight flexible cover made for Tupperware 8 oz. Tumblers also fits and is sold with all Tupperware Funnels as a base when funnels are used as storage containers.

TUPPER CORPORATION

TUPPER

Manufacturers of — CONSUMER, INDUSTRIAL, PACKAGING AND SCIENTIFIC PRODUCTS

FACTORIES: Farnumsville, Mass., and Cuero, Texas **New York Show Rooms 225 Fifth Ave.**

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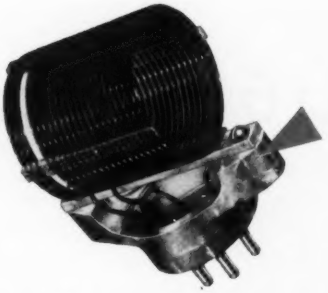
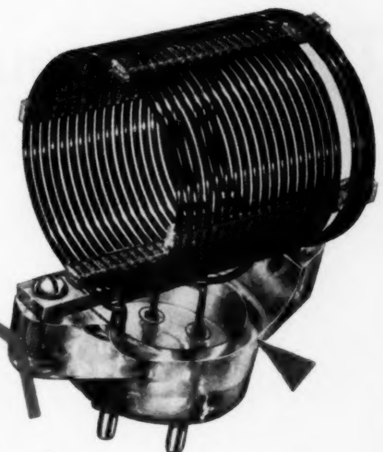




Costly breakage

REDUCED BY CHANGING TO KOPPERS POLYSTYRENE

Base of this plug-in coil is injection molded from Koppers Polystyrene 8X. Manufacturer: Bud Radio, Inc., Cleveland, Ohio. Molder: Nylon Molded Products Corp., Cleveland.

● Bud Radio, Inc., Cleveland, Ohio, solved two troublesome problems in the manufacture of these plug-in coils for radio transmitters by changing the coil base to Koppers Polystyrene 8X.

"We have found Koppers Polystyrene especially suited to our purpose," says A. N. Haas, company president. "We no longer have the problem of breaking or cracking that was all too common with a porcelain base.

"In addition, we find that the problem of bent or distorted pins has been completely eliminated. With a porcelain base, it was necessary to spin the pins in the base. But the use of Koppers Polystyrene permits them to be molded into the base."

Excellent electrical properties, low cost, light weight and good moisture resistance are other advantages of Koppers Polystyrene in this particular application.

Our services are available to advise you how best to use your currently limited supply of polystyrene, and to help in planning better future products.

KOPPERS

Koppers Plastics

Koppers Polystyrene has made Many Products Better and Many Better Products Possible.

KOPPERS COMPANY, INC., Chemical Division, PITTSBURGH 19, PA.

SALES OFFICES: NEW YORK • BOSTON • PHILADELPHIA • CHICAGO • DETROIT • LOS ANGELES

Tired of Frammis En La Gahookis, Smerg?

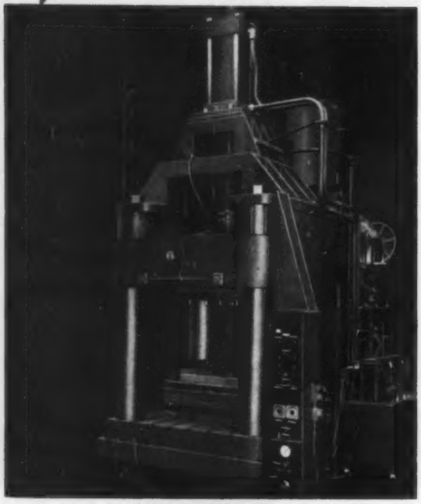
You get no mumble-jumble double talk here at Boonton. Over 30 years of plastics experience have taught us that it's as easy to figure out a way to do a job as it is to cook up an excuse for not doing it. And it's a lot more profitable—to both us and our customers.

Give us your blue prints. Let's talk it over together. We'll explain as plainly as the multisyllable nomenclature of the plastics industry will let us—just what the job will cost and why . . . and how many we can deliver and when. Even if we can't do it you get a fast straight answer. In all cases you know what the score is at every stage of the game.

After all there must be some value in years of experience and a good reputation. Some good reasons why our list of successful clients keep entrusting us with their molding requirements year after year. Why not check with us and see how you can benefit by straightforward questions and answers on your molded plastics product.

BOONTON MOLDING CO.
BOONTON, NEW JERSEY
N. Y. Office—Chanin Bldg., 122 East 42nd Street,
Murray Hill 6-8540

The "now-it-can-be-told"



J & C 200 oz. press installed at General Electric, Decatur, Ill.

G. E. OPERATES PRE-PLASTICIZING LARGEST PARTS BY PERFORMANCE

ENGINEERING DATA ON THE 200 OZ. JACKSON & CHURCH PRE-PLASTICIZING PRESS FEATURING THE HENDRY PROCESS

CAPACITY	208 oz. of polystyrene on 30 sec. cycle
POTENTIAL CAPACITY	300 oz. at 45 sec. cycle with substitution of 300 oz. chamber
PLASTICIZING CAPACITY	1200#/hr (1000#/hr on continuous basis)
SPEED OF INJECTION	180" per minute minutely flow-controlled down to 10" to 15" per minute
CLAMPING PRESSURE	2000 tons
INJECTION PRESSURE	100 tons
SPEED OF UNIT	410" a minute going up -- 475" a minute coming down (slowed up at both ends for clamping and knock-out)
WEIGHT	135 tons exclusive of oil
CAPACITY OF OIL RESERVOIR	1600 gallons
SCREW DIMENSIONS	6" diameter, 110" long
HEAT	76,000 watts split among six thermo-couples controlled by Wheelco Regulators plus an additional 2000 watts on nozzle controlled by separate Wheelco
TEMPERATURE CONTROL ZONES	Seven on 200 oz. machine, eight on 300 oz.
OPERATION OF INJECTION RAM	1000# line pressure driven forward with 122 gallons of oil per minute to develop 10,000 p.s.i. on material in chamber
DRIVES	Hydraulic unit--75 H.P., 1200 R.P.M. G-E motor extrusion unit--75 H.P., 1800 R.P.M. G-E motor extrusion screw--140 R.P.M. screw speed driven by water-cooled clutch
CLUTCH	Eddy current; comes up very slowly to 140 R.P.M., then coasts down very slowly

PLASTICS FOR INDUSTRY

The Murray Co. of Allentown, Pa. selected Cruver to produce a decorative nameplate for their fine line of electric stoves

The nameplate is molded in acrylic and decorated in brite silver and white using Cruver's Bas Reelef method.

The finished nameplate is then mounted in a Metal bezel as shown in the above illustration.

CRUVER

MANUFACTURING CO.

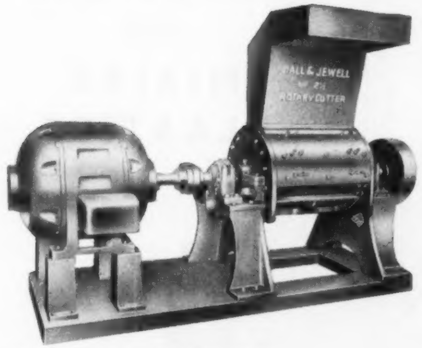
2460 W. JACKSON BLVD., CHICAGO 12, ILL.

BRANCH OFFICES

DETROIT MINNEAPOLIS NEW YORK

CLEVELAND ST. LOUIS

B&J BUILDS THE ANSWER TO ANY GRINDING PROBLEM —

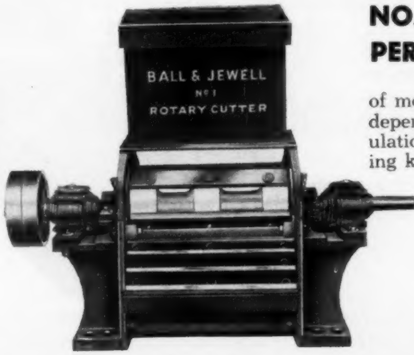


with the "right" cutter to meet each individual requirement!

B & J has a complete line of grinders with capacities ranging from 50 to 3,000 pounds per hour—big cutters for big jobs . . . midget cutters for small jobs.

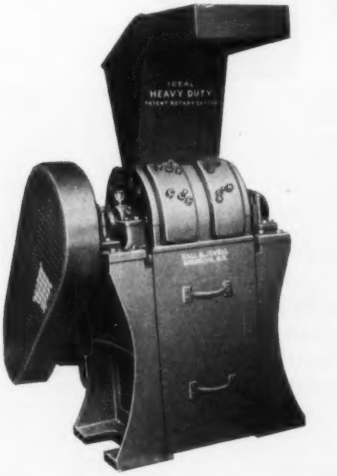
NO. 2½ MEETS BIG CUTTING NEEDS!

At up to 3,000 lbs. per hr., this B & J cuts almost any size or weight material that can be fed into 36″ x 11″ throat. This allows for feeding of extra large lumps without prior breakdown.



NO. 1 - 1,000 LBS. PER HOUR...

of molding powder can be cut, depending on size of granulation desired. With 5 revolving knives, this medium B & J provides large productive capacity for its size.



HEAVY DUTY IDEAL REDUCES HEAVY STOCK UP TO 1″ THICK

Here is a sturdy B & J machine with semi-steel castings and extra heavy construction throughout. It's built for tough cutting requirements at rate of approximately 250 lbs. per hr. Available with sizable 6¾″ x 10″ throat opening.

For grinders with capacity of 50 to 3,000 lbs. per hr. contact:

BALL & JEWELL

MAIL COUPON NOW!

Ball & Jewell, Inc.
26 Franklin Street, Brooklyn 22, N. Y.

Please send us complete data on:

☐ Heavy Duty Ideal
☐ No. 1 ☐ No. 2½

Name ....

Company ....

Address ....

City .... State ....

YOUR NEAREST B & J REPRESENTATIVE

SAN FRANCISCO, CALIFORNIA: B-H-S Machinery Sales Company; LOS ANGELES, CALIFORNIA: Machinery Sales Corporation; PITTSBURGH, PENNSYLVANIA: Stanley Berg & Company; OMAHA, NEBRASKA: Fuchs Machinery & Supply Co.; CINCINNATI, OHIO: Index Machinery Corporation; SPOKANE, WASHINGTON: W. R. Matthews Machinery & Tool Supply Company; CHICAGO, ILLINOIS: Neff Kohlbusch & Bissell; MILWAUKEE, WISCONSIN: Neff Kohlbusch & Bissell; HOUSTON, TEXAS: Preston Machine Tool Sales Co.; MINNEAPOLIS, MINNESOTA: Charles W. Stone Company; LEOMINSTER, MASSACHUSETTS: Standard Tool Company; DETROIT, MICHIGAN: Thoreson-McCosh, Inc.; CANADA—TORONTO & MONTREAL: Williams & Wilson Ltd., FOREIGN DISTRIBUTORS: Omni Products Corp., New York 16.

No one has bettered the SHAW INTERMIX

FOR MIXING PLASTICS

The Intermix plays an important part in any large-scale mixing operation, and it is made in a range of sizes to cover modern requirements.

Rotors are designed to give a high degree of dispersion and uniform distribution of ingredients within the plastic compound.

OUTSTANDING ADVANTAGES

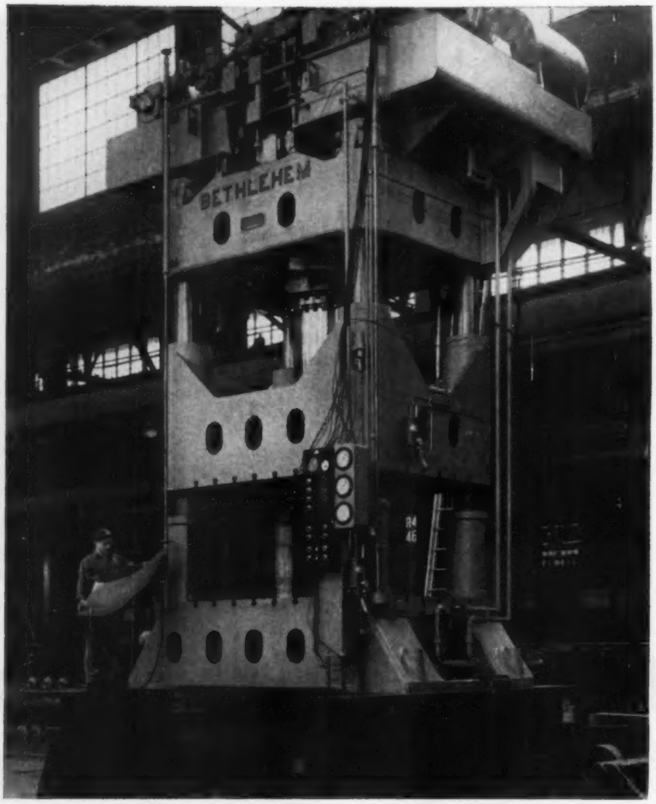
The rotors are mounted on special roller bearings which take the axial as well as the radial thrust, and eliminate bearing wear. The overall location of the rotors reduces wear in the mixing chamber and on the discharge slide, so often found in other internal mixers.

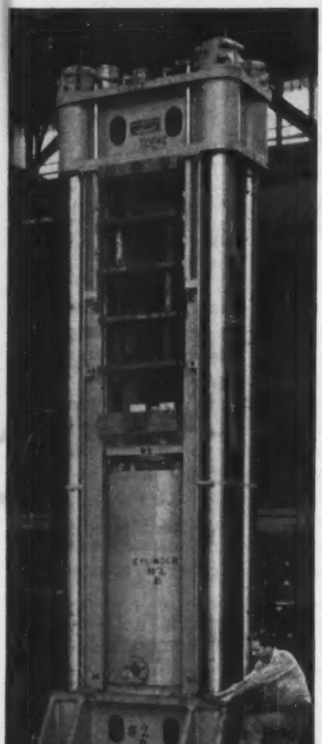
MANUFACTURED UNDER LICENCE IN U.S.A. BY THE ADAMSON UNITED COMPANY, AKRON 4, OHIO

FRANCIS SHAW & COMPANY LIMITED
MANCHESTER 11 · ENGLAND

R-211

4 POINTS TO CONSIDER WHEN YOU ORDER A PRESS





These four basic points deserve the closest study when you plan to order hydraulic presses: (1) the builder's engineering staff, (2) his shop set-up, (3) his experience in the business, and (4) his willingness and ability to create the type of press you want.

On all four points, you can feel secure when you engage Bethlehem to build a press. Our staff includes engineers of high standing in the field of hydraulic machinery. You'll find, too, that our shops are more than equal to any building job you require; we make our own forgings and castings, do all the assembling, testing, etc.

Experience? Bethlehem's dates back many years. And you can be sure that a Bethlehem-built press will meet your every specification, down to the last bolt and nut.

Call us when next in the market for hot-plate, molding, or metal-forming presses. We make them in a wide range of sizes, and any unit can be furnished with or without power system, as you prefer.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM
Custom-Built
HYDRAULIC PRESSES
FOR
PLASTICS • FIBER BOARD • WALLBOARD
LINOLEUM • METAL-FORMING • VULCANIZING

BETHLEHEM STEEL

PLASTICS SCRAP

bought
sold
reworked

OUR SERVICE

As the world's leading Plastics Scrap Reclaimers we offer the almost unlimited facilities of our vast plant to industry in these days of shortages in all basic raw-materials.

We have available over 150,000 sq. ft. of floor space devoted exclusively to the processing of plastics — virgin and scrap — resinous materials or by-products.

We specialize in the reduction to small particles — to your most exacting specifications — of all lumps, blocks, mill ends, bleeder waste — regardless of size and whether rigid or soft.

We also custom-compound *all* thermoplastics to your specifications.

We offer
the World's finest facilities for:
RECLAIMING • REPROCESSING
RECOMPOUNDING • RECOLORING

We reprocess *Your* Plastics Scrap, By-Products, Surplus for *Your* own Re-Use.
We have complete laboratory facilities for Testing, Analyzing, and Pilot Running of Customer's Materials.

GRANULATING • PELLETIZING
CHEMICAL FLOTATION • WASHING • CLEANING • DRYING
SEPARATION OF CONTAMINATED MATERIALS
REMOVAL OF FOREIGN MATTER
COMPOUNDING • MIXING • COLORING • EXTRUSION

UNLIMITED KILN DRYING FACILITIES

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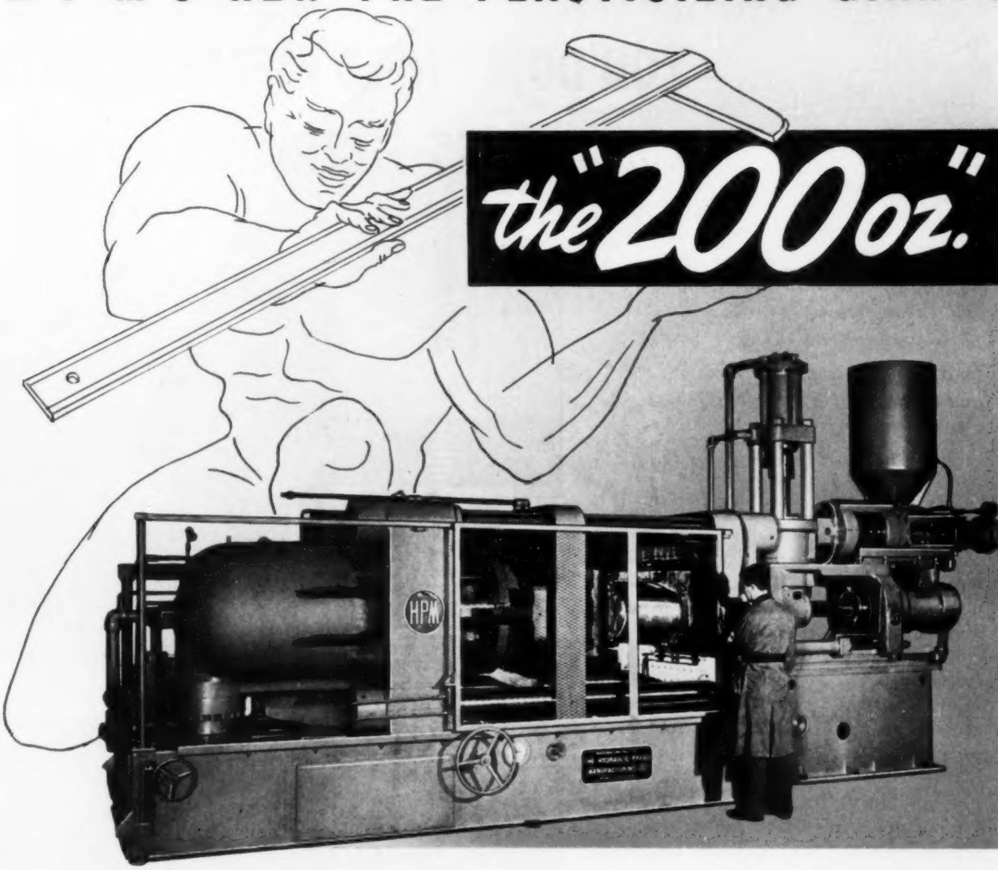
PLASTICS MATERIALS
703 Bedford Avenue, Brooklyn 6, N. Y.
Phone: MAin 5-7450
CABLE: CHEMPROD BROOKLYN

H-P-M's NEW PRE-PLASTICIZING GIANT!



THE ONLY MACHINE That Plasticizes without Affecting Molding Cycle Time!

Here is a new machine which will cut seconds and even minutes on your big injection molding jobs! It is the first and only machine which plasticizes molding material independent of the rest of the machine cycle. It offers you all the advantages of preplasticizing . . . low injection pressures . . . high speed injection . . . big shot capacity . . . extremely fast plasticizing rate. Yes, it's designed especially for those big molding jobs where cycle time is of key importance.

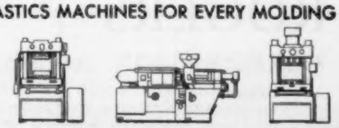
A careful analysis of the many advantages this machine has to offer will prove without a doubt that the H-P-M 200 oz. will out-plasticize, out-cycle and out-produce any big capacity machine which has yet been developed. If you are now a molder of "big" parts or you are considering bigger molding jobs, investigate this new 200 oz. preplasticizing giant.

HPM

THE HYDRAULIC PRESS MFG. CO.

1010 MARION RD., MT. GILEAD, OHIO, U. S. A.

PLASTICS MACHINES FOR EVERY MOLDING JOB




S·H·8/10
10 ounce capacity
injection moulding machine
SERVING THE WORLD'S
Windsor
PLASTIC MACHINES
TRADE MARK
PLASTIC INDUSTRY
S·H·16/20
20 ounce capacity
R·C·65
R·C·200
R·C·100

HERCOCEL*E ANSWERS a Call for Ethyl

. . . this time from the Signal Corps for the telephone handsets used in mobile units. It's a call for top performance in plastics whatever the time or place. This durable all-weather plastic serves well under conditions ranging from arctic cold to tropic heat and humidity, in a variety of applications involving severe exposure.

As a result of many such calls, the present supply of Hercocel E available for non-defense needs has been sharply curtailed. But there's still no limit here at Hercules on the design and technical assistance available to you in the long-range development of new uses for this versatile *quality* plastic. We invite your inquiries.

HERCULES POWDER COMPANY Cellulose Products Department • 916 Market St., Wilmington, Del.

MOLDABILITY
•
IMPACT STRENGTH
•
DIMENSIONAL STABILITY
•
LIGHTWEIGHT
•
DURABILITY
•

Signal Corps telephone handset molded with Hercocel E (ethyl cellulose molding powder) by Cowan-Boyden Corporation, Providence, Rhode Island, for Connecticut Telephone & Electric Corporation, Meriden, Conn.

HERCULES Cellulosic Plastics

*TRADE-MARK

CP51-6

PLASTICS MACHINERY BULLETIN

Reporting News and Machine Design Developments

IN BUSINESS TO **NRM** REDUCE YOUR COSTS

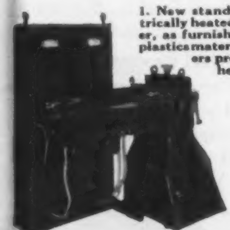
NYLON—New NRM Extruders handle Nylon, other plastics

New NRM electrically heated Extruders offer you a valuable plus—with them you can extrude Nylon as well as a variety of other plastics in various forms. With versatile NRM Extruders, producers often avoid purchase of extra equipment.

Standard NRM Models of the new design can be adapted simply and easily in the field, by removing the standard die or crosshead, and substituting a special Nylon die or crosshead. The steps required are shown below.

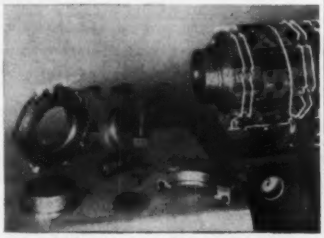
NRM's Nylon Extruders range from a completely self-contained 1"-screw bench model, up through 3½"-screw machines, and larger, if desired. They are currently being used for wire covering and a variety of other applications.

Write for full information to Plastics Machinery Division, National Rubber Machinery Company, Akron 8, Ohio.

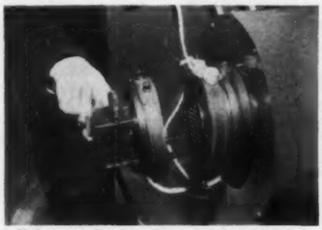


1. New standard 2½" electrically heated NRM Extruder, as furnished for general plastics materials. Two blowers provide balanced heat control.

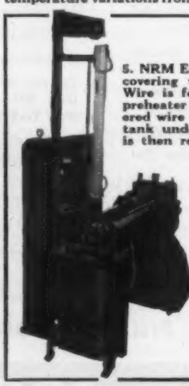
2. Die gate swings open easily on hinges. The new front flange is split for easy removal.



3. Standard die gate, subdie, strainer plate, and front end removed from extruder. Note cylinder heater shells and blower for balanced heat control.

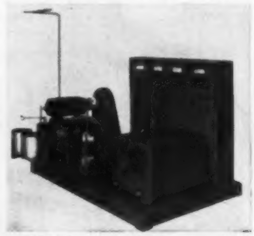


4. Nylon crosshead or die is positioned for bolting directly to cylinder face. This avoids critical temperature variations from heat loss of flange.



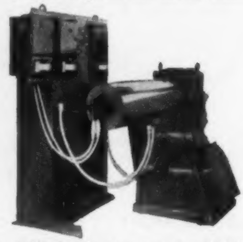
5. NRM Extruder set up for covering wire with Nylon. Wire is fed down through preheater to extruder. Covered wire is cooled in water tank under extruder head, is then ready for winding.

Self-contained Nylon Extruder



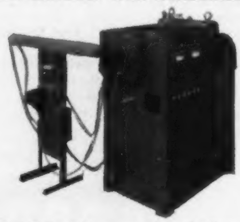
This 1" NRM bench model is a completely self-contained unit for Nylon covering of wire, sizes B & S Gauge #24 to #36. Unit includes electrically heated extruder, let-off, cooling tank, spark tester, dual capstan, dual take-up, and instrument and control cabinet.

Extrudes Nylon on steel ribbon



Wide application is characteristic of NRM Extruders. This 2½" model is used to cover a thin steel ribbon with Nylon to produce corset stays. In this unit feed is horizontal. Replacement of heads is simple matter.

Nylon Extruder with horizontal feed



NRM 1½" Extruder arranged for horizontal feed of wire through preheater. Only NRM Extruders provide balanced heat control, with absolute control over frictional heat. This feature is self-contained, requires no pipe connections for compressed air, oil, or water.

NATIONAL RUBBER MACHINERY Co.

General Offices & Engineering Laboratories
Akron 8, Ohio

PLANTS at Akron and Columbiana, Ohio and Clifton, N. J.
AGENTS East: National Rubber Machinery Co., Clifton, N. J.
West: S. M. Kipp, Box 441, Pasadena 18, Calif.
EXPORT Plastics Machinery: OMNI EXPORT CORPORATION
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Creative Engineering

<u>No</u> <u>One</u> but <u>MODGLIN</u> can Manufacture these leading Housewares Items

FORMAL NOTICE OF ISSUANCE OF
U. S. PATENT NO. 2,544,763
dated March 13, 1951
COVERING METHODS OF MAKING FIBRES

TO WHOM IT MAY CONCERN:

Modglin Company, Inc. has pioneered in the development of plastic brooms, whisk brooms, push brooms and related products using plastic bristles.

Intensive research and experimentation has been required to develop the bristles used in these products, and we are pleased to announce that our efforts have been rewarded by the issuance of the above-described patent covering the process used in making such bristles.

The products referred to in this advertisement are some of the products developed by Modglin Company, Inc., and using bristles which are covered by U. S. Patent No. 2,544,763. Further products will be on the market shortly.

United States patents are intended to protect the Company that originates and develops new methods and products, and to prevent the simulation of such products and the use of such methods during the effective period of such patents.

Modglin Company, Inc. will protect according to law the exclusive rights granted it pursuant to Patent No. 2,544,763.

Very truly yours,
MODGLIN COMPANY, INC.
BY Wm. N. Modglin

PERMA-SCRUB

Revolutionary new utensil for scrubbing pots, pans. Removes grease, burned food without getting hands in dishwasher. Many gay colors.

PERMA-BROOM

Efficient plastic broom with Electrene bristles. Light . . . durable . . . washable. "Magnetic action" of fibres picks up dirt as you sweep. Many gorgeous colors.

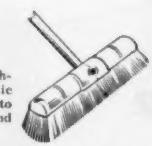
WHISK-OFF

Beautifully designed new plastic whisk broom with Electrene bristles. Light, durable, washable. Comes in three sizes, many beautiful colors.

PERMA-BROOMETTE

Child-size toy broom, genuine small version of the Perma-broom. "Just like Mother's", useful in scores of household chores.

PERMA-PUSH



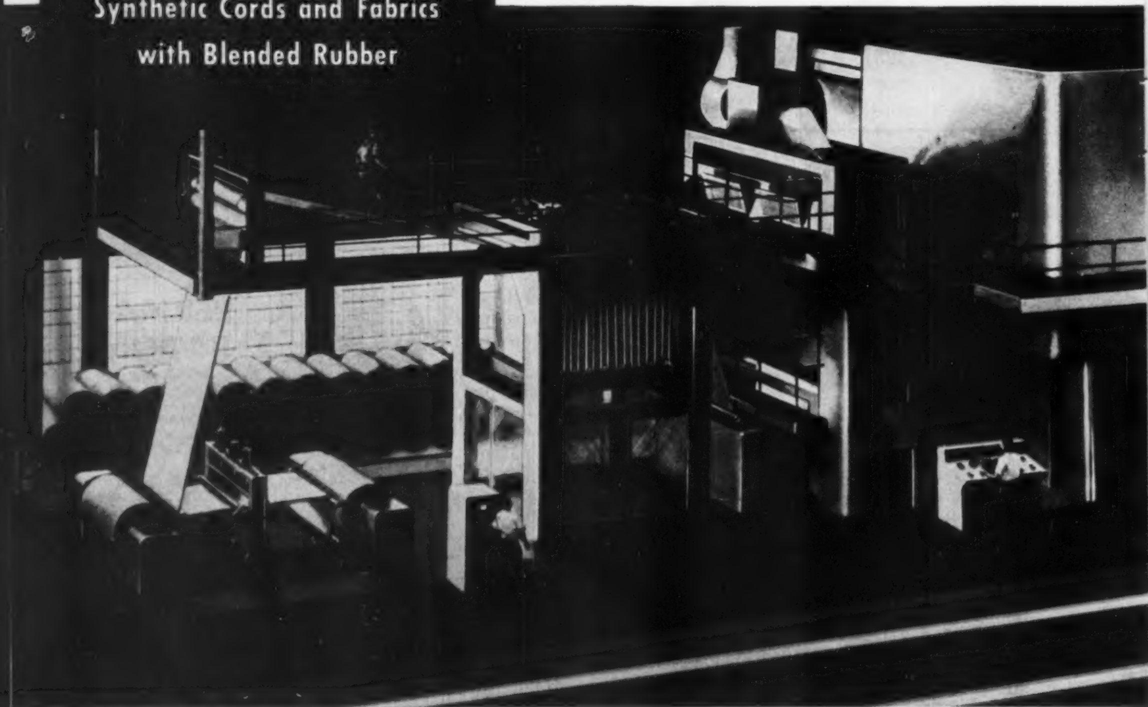
Efficient, long-wearing push-broom. Durable plastic Permene fibre resistant to cleaning solutions, water and petroleum products.

These revolutionary new brushes and brooms with plastic Electrene bristles, available only from Modglin, are setting sales records from Coast to Coast. Display and they sell themselves! Immediate deliveries are made from Modglin warehouses in New York, Chicago and Los Angeles. Write today for details and learn how Modglin products can pay you faster, larger profits from smaller shelf and floor space.

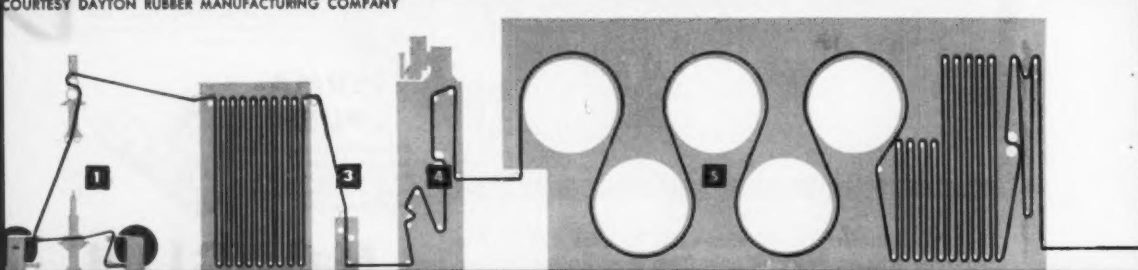
MODGLIN
COMPANY, INC.
3235 San Fernando Road
Los Angeles 65, California
New York 1, N. Y. Chicago 9, Ill.

Continuous and electronically

For the treatment of all types of Natural and Synthetic Cords and Fabrics with Blended Rubber

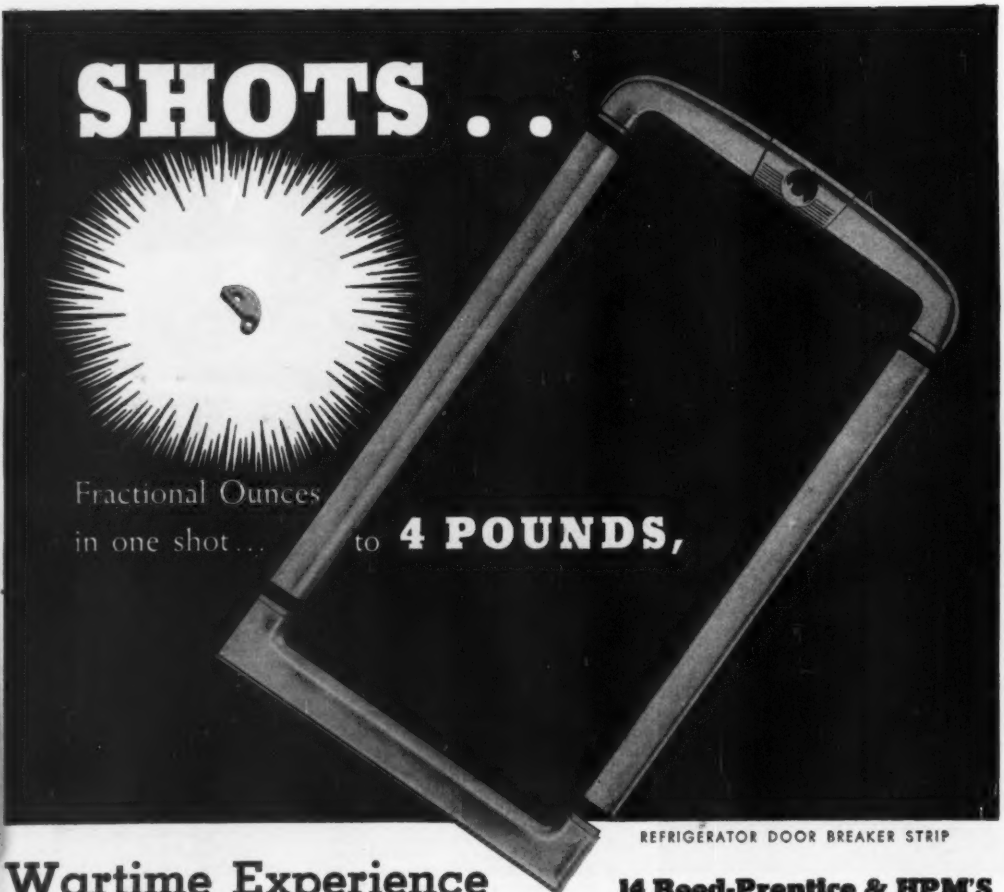


COURTESY DAYTON RUBBER MANUFACTURING COMPANY



This all electronically controlled tandem operation, *the first ever to be assembled,* treats all types of natural and synthetic cord fabrics with blended rubber in one continuous, high speed operation, eliminating the frequent re-handling of material in the many separate and slower operations formerly required. The unit adjusts to predetermined standards, by finger-tip control, the strength and elongation of the fabric, surrounding and impregnating each cord with blends of rubber. It dips, stretches, impregnates and coats at speeds up to 180 feet per minute. By synchronized electronic methods the highest quality of treated cords and fabrics is maintained to an exact degree of uniformity, with constant tension maintained at all points throughout the process.

4 to 60 ounce



REFRIGERATOR DOOR BREAKER STRIP

Wartime Experience

14 Reed-Prentice & HPM'S

Look up your files of past orders to APCO . . . or write for list of over 200 leading U.S. manufacturers who have relied on APCO in the last two years. Toughest moulding problems solved wtih creative engineering skill, high quality, quick delivery, and right price.

SUB - CONTRACTORS - CONTACT US TODAY

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APCo
CHICAGO, ILL. MADE IN U.S.A.

General Offices
Suite 1195
Merchandise Mart
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ASSOCIATED PLASTIC COMPANIES, INC.

WHICH OF THESE PROPERTIES DOES YOUR VINYL PRODUCT NEED?

PARAPLEX G-60

Plasticizer-Stabilizer for Vinyl Compounding

PARAPLEX G-60 plasticizing resin gives you the permanence of a polymeric plasticizer—plus low cost and low viscosity of a monomeric!

Light in color and widely compatible, PARAPLEX G-60 is efficient at low temperatures, stable and non-volatile at fluxing temperatures, exhibits *unique* stabilizing action.

For full technical data on PARAPLEX G-60, its uses and suggested formulations, write Dept. CEL-2. There's no obligation.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

Washington Square, Philadelphia 5, Pa.

Representatives in principal foreign countries

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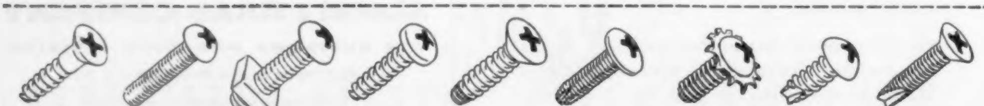

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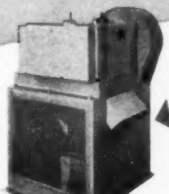

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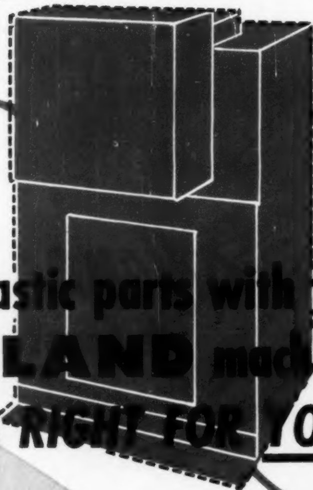

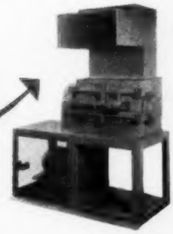

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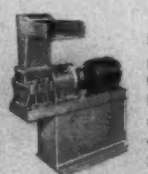

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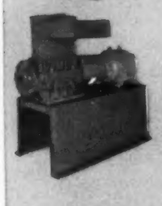

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PLASTICS ENGINEERING CO.

Sheboygan, Wisconsin

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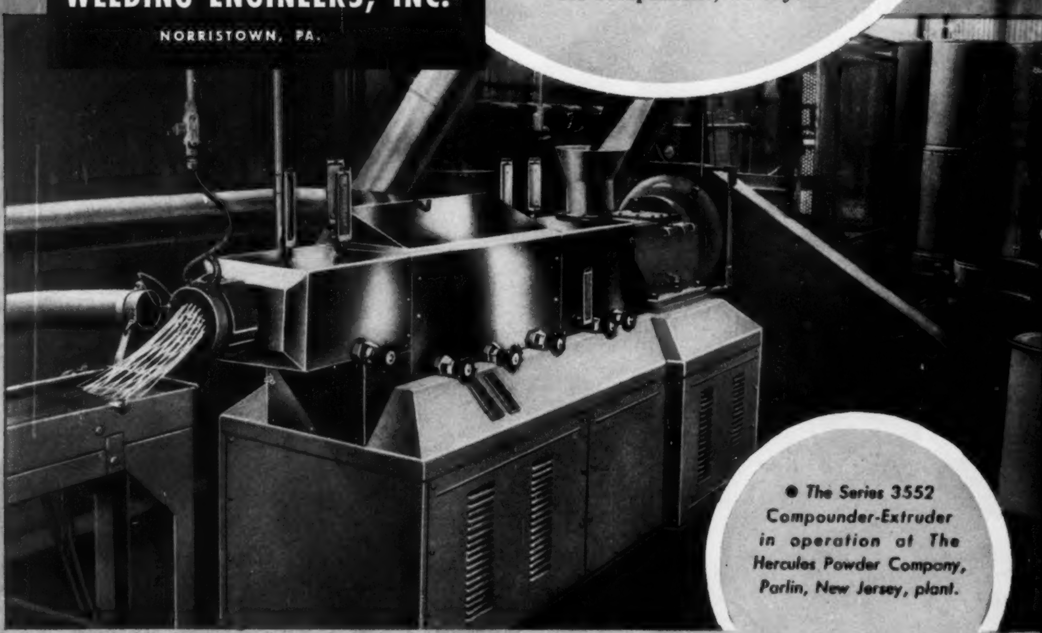

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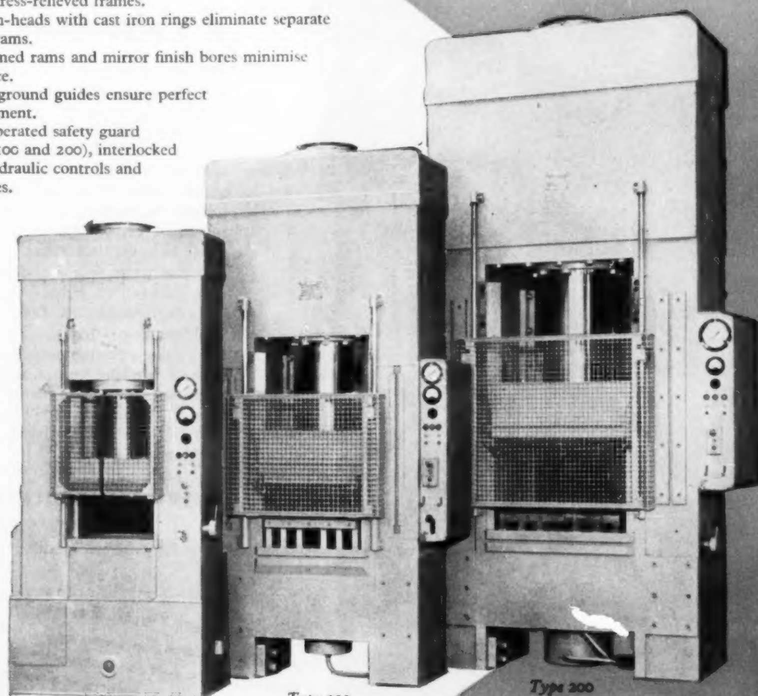

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20 *to* 60 *tons*

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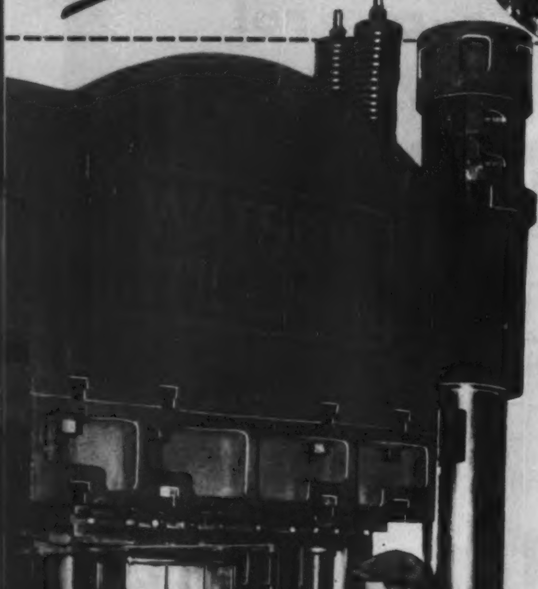

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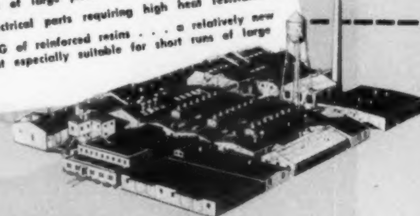

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A SPECIAL SERVICE TO MODERN PLASTICS READERS, REPORTING AND INTERPRETING THE LATEST NEWS AND DEVELOPMENTS FROM WASHINGTON AND ELSEWHERE AS THEY AFFECT THE PLASTICS INDUSTRY AND THE MOBILIZATION PROGRAM

Modern Plastics BULLETIN

June 18, 1951

Polyethylene Allocation Hits Hard

Quite a rumpus was raised during the first month of allocation of polyethylene. It would seem that most users were either inexperienced in the matter of wartime scarcities handling, or didn't realize that the word allocation is practically synonymous with "cutback" when applied to the government's method for channeling material where it is most needed. Very few users received as much material as they had hoped for on their first allocation, even though none expected to be granted the total amount for which they asked.

The first shock — even NPA officials were surprised — was the amount required for military use. At least 50% went for this purpose as against an expected 40 percent. One supplier who had contended all along that military orders were larger than commonly believed was vindicated and is warning again that military orders will probably continue to take an increasing percentage.

34% for essential civilian goods

The second shock was greater than the first: 34% of all polyethylene production would have to be allocated to essential civilian production, thus leaving only 16% free for suppliers to distribute as they saw fit. The big claim for essential items was, in effect, set up by the Government's claimant agencies such as the Dept. of Agriculture and branches of the various defense agencies. They wanted polyethylene for communications, medicine containers, mine pipe, and a score of other things. Here's how this 34% of polyethylene was divided up in the form of bulk liners, multi-wall bags, coated paper, wax mixes, and molded and extruded parts:

Packaging materials for dehydrated milk and dehydrated milk products; for bulk chemicals and pharmaceuticals; camelback for rubber; packages for frozen food, including eviscerated poultry, to be used at the household or industrial level; fresh produce packages made from tubes, bags, or sheets; for meat, meat products, and fish for use at packer level in packages containing food for human consumption; for chemicals and medicinals (bottles for medicinal use only); containers for agricultural supporting items such as fertilizer, seeds, and insecticides; for mine piping and coupling; for Alpeth cable for communications; in closures for chemicals, drugs, and pharmaceuticals, but not including cosmetics or deodorants; for agricultural pipe and couplings for farm water systems not including irrigation syphons.

The two classifications receiving heaviest allotments were packaging for bulk chemicals and Alpeth cable. After the military and the above allocations were made, the remaining 16% was called "free"; that is, the supplier could distribute it as he saw fit, which was generally according to a percentage of the customer's historical purchasing record. If a processor had a lot of DO and essential civilian business, he received lots of polyethylene; if not, he was hard hit —awfully hard hit.

Next month's allocation to be adjusted

NPA officials point out that adjustments in the system will be forthcoming during the next few months. Some of the military orders will be trimmed in quantity; the essential civilian list will not only be trimmed in quantity but some of the items will go on the "free" list. Thus, material requested for those items will be referred back to the supplier, and he rather than the Government will determine how much the customer will get for a specified purpose.

Requisitions on the suppliers in June were double the amount of polyethylene actually produced. Since half of the production volume was ticketed for military, it can be seen that civilian requests were 300% of availability. Some of the heavy requests came from "loaded" orders; that is, processors asked for enough to fill all the orders on their books—not just enough to keep them in operation for one month.

Loaded orders violate Reg. 2

Such loaded orders were in violation of NPA Reg. 2, an inventory order which limits stock to a one month's supply. It is assumed that such violations were generally in error and that a warning will suffice to end such practice. If the practice is repeated, the firm in question will end up with no polyethylene at all. Furthermore, loading doesn't help get any more material, and here's why:

When the supplier sends his lists to the Government, he lumps each category (camelback, Alpeth, etc.) together; that is, he lists the number of pounds wanted for each. The Government then cuts this amount according to essentiality and the amount of material available. The supplier furnishes material for the DO business; then knocks out the orders of those firms without a historical purchasing base; then *pro-rates* the amount of material to each customer for the so-called essential or programmed items from the bulk quantity which the Government has allowed for each category. After this last operation, the supplier distributes the "free" material, taking into consideration what the customer has received for DO and essential goods.

Naphthalene Shortage Threatens Vinyls

We have discovered to our amazement that little cognizance is being given to the storm signs which have been displayed on the possibility of a phthalate plasticizer scarcity during the last four or five months of this year. The seriousness of this scarcity will, of course, depend somewhat upon the amount of vinyl resin available. But if all the new capacity for resin now talked about comes in this fall there is likely to be trouble in obtaining enough plasticizer to go with it. Perhaps one reason why the warnings have thus far been ignored is that up until now there has been less trouble in obtaining phthalate plasticizers than in obtaining vinyl resin.

Cut-back in imports

The basic threat is that imported naphthalene, used in the production of phthalic anhydride, a constituent of phthalate plasticizers, will be cut off after June. Naphthalene is a coal tar derivative and, like benzol, domestic production has been largely dependent upon the coke ovens operated by the steel companies. Consequently, there is no quick way of building up more volume.

Figures on domestic naphthalene production are extremely confusing. The total Government figure for naphthalene in 1950 is 380 million lb., but analysts say that this includes errors in reporting and does not account for the fact that the amount of crude used for refining is reported as both "crude" and "refined." In any case, Washington officials believe that total crude production in the U.S. in 1950 was under 250 million pounds.

Europeans will use all their production

But naphthalene imports in 1950 were extremely high—over 110 million pounds. Part of this was refined after importation, thus bringing the total down to a little under 100 million lb., but it is easy to see what an important part this importation played in last year's volume. In former years, importation was generally under 50 million pounds. This year's imports may be as low as 30 million pounds. There are three reasons: the European barrel was scraped of inventory; Iron Curtain countries have cut us off; Atlantic Pact nations need their naphthalene for their own defense program. This is no crying towel. Proof has already been established that naphthalene imports are now down, following January and February imports at the high 1950 level.

One and one quarter lb. of naphthalene is needed for conversion to one lb. of phthalic anhydride. About 242 million lb. of naphthalene were used for this purpose in 1950. The balance was used largely for moth-proofing. It is conceivable that over 300 million lb. of domestic crude naphthalene will become available in 1951; how much of this will go to phthalic is uncertain and the foreign imports mentioned above will help out, even though only to a small extent.

Phthalic Anhydride Bottleneck

The naphthalene shortage mentioned above is expected to interfere with phthalic anhydride production in 1951, but the 1951 total is expected to be considerably more than in 1950. The trouble is the same as with other synthetics: the customers want too much.

Production figures for phthalic anhydride over the past three years are:

1948	160,000,000 lb.
1949	150,000,000 lb.
1950	215,000,000 lb.

Anticipated 1951 production is 235 million pounds. The big squeeze in phthalic at the moment is for government orders, which have doubled each month for the past two months. In addition to undisclosed uses for military purposes, great quantities of phthalic are being used for alkyd paints. Military orders for paint are heavy. All synthetics—styrene, phenolics, and others—seem to be involved in this great demand for surface coatings. Plasticizers for vinyl take the next largest quantity of phthalic, but acetate plasticizers such as dimethyl and diethyl phthalate make sizeable demands; dibutyl phthalate, wanted partic-

ularly for smokeless powder, is also a heavy user. The total quantity of phthalic, according to one company's research survey, is divided about as follows:

Paint	55%
Plastics	33%
Dyes	8%
Misc.	4%

The secret government uses previously mentioned will show up more in these statistics as time goes on. Working with the above figures, it is calculated that about 70 million lb. of phthalic is used for plastics, with 37 to 40 million lb. of that amount going into an estimated 90 million lb. of plasticizers for vinyl. The estimated increase of 20 million lb. of phthalic in 1951 will not be enough to meet demands, according to the analysts, because of the expected increases in production of vinyl resin and surface coatings.

Paint Cuts Into Plastics' Raw Materials

As with everything else these days, there is no unanimity of opinion on the phthalic situation. The fact that one producer of both resins and phthalic is now also selling both is held by one observer to be an indication that the market has softened. That observer also believes that the decline in auto and hard goods production this fall will lower the requirements for alkyd paints and thus make more phthalic available for plasticizers. The other side of the argument is that no one is particularly perturbed about the phthalic shortage at this moment; it is almost in balance. The trouble will come next fall when naphthalene tightens up. And as for a declining use in alkyd paints, the other side holds that the probability is that military equipment which also requires alkyd coatings will more than absorb the amount saved by civilian cut-backs.

How Much Plasticizer Will Be Needed?

The heart of the plasticizer supply problems lies more in how much vinyl resin will be produced this fall than in the possible availability of phthalic anhydride. If production of resin should remain at present levels, there shouldn't be too much trouble over plasticizers. But if all present plans materialize, vinyl chloride and copolymer resin capacity as of Jan. 1, 1952, could be 425 million lb., according to reliable estimates. Last year's consumption was around 300 million lb., which required between 110 and 120 million lb. of plasticizers.

The industry is expecting to need more than this total in 1951, but how *much* more may depend upon the availability of chlorine and acetylene from which vinyl resins are produced. No one will even guess at this point how much more chlorine and acetylene can be squeezed out for vinyl during the balance of this year, but every producer of vinyl resin expects to increase his production rate in the latter half of this year. In addition, Dow is reported to be bringing in sizeable new quantities of monomer and possibly polymer. Shell denies the rumor that it will produce vinyl this year. The monomer availability is particularly important to two or three polymer producers who don't make their own or enough of their own and who have been seriously handicapped in getting enough ever since the chlorine strike last year.

Phenolics Continue at High Level

Many persons are still perplexed at the continuing high production of phenolics in view of various material shortages and the cut-back in autos, television sets, and other items that use phenolic parts. In spite of all the yipping about how the production of molding powder would fall off in the early months of the year, it continued at or near the 20 million lb. figure; other phenolics were generally on the upgrade. It is also noticeable that DO orders have been creeping up for all-over phenolics and have now reached a total of from 25 to 35% of total production. Molding powder is under that percentage but rising each month.

DO business on the increase

The biggest percentage of DO orders is probably in the resin used for protective coatings. Adhesives for plywood are also high. Resin for insulation binders is well up on the DO list due to military construction. Low density glass wool for aircraft mattresses and similar equipment uses about 15% by weight phenolic resin; normal insulating glass wool for buildings uses about 8 percent. Sand-resin foundry core use is kept from advancing only by the scarcity of resin; Ford is reported ready to change over completely to this process even though it means a change in facilities. This use will cut heavily into phenolic resin usage before the year is over.

Despite these developments, NPA officials believe that the phenolic resin situation will be in balance just as soon as Bakelite's new phenol plant comes into production. That should be in the very near future. No one is predicting today exactly when a new plant will come in; there has been too much sad experience in hold-backs due to inability to obtain and install equipment.

Of course there is always the possibility that the formaldehyde shortage will affect phenolic production, and formaldehyde is today one of NPA's greatest worries. The sulfur shortage, also, may back into the phenolic situation since sulfur is used in one process in manufacturing phenol.

Amount of phenol used for plastics

Revised figures on the amount of phenol used for all types of phenolics, based on 1950 production figures, follow:

	Conversion figure	*Finished material (lb.)*	*Phenol (lb.)*
Molding powder	0.42	220,000,000	92,400,000
Laminating resins	0.9	72,000,000	64,800,000
Adhesives	0.8	30,500,000	20,000,000
Protective coatings	0.6	23,000,000	14,000,000
Miscellaneous	0.9	66,000,000	60,000,000

About 30 million lb. should be deducted from the total shown for laminates, since about that amount of cresol was used instead of phenol in laminating varnishes. An allowance has been made in the above figures for about 5 million lb. of other materials used in adhesives. The total comes to about 220 million lb. of phenol used for phenolics or around 65% of the total 1950 production of 310 million pounds. These figures are estimates only, since no two persons would ever come up with the same set of statistics. The figures are given here particularly because of a misunderstanding created in this column two months ago when we inadvertently referred to 48% of all phenol being diverted to phenolics when we were talking about molding powder only.

New Facilities for Styrene Monomer

Of particular interest to the plastics industry are recent certificates of necessity granted as follows:

Name of company	*Product*	*Amount applied for*	*Amount eligible*	*Percentage certified*
Monsanto Chem. Co. Texas City, Texas	Styrene monomer	$ 8,600,000	$ 8,600,000	50
Dow Chem. Co. Freeport, Texas	Styrene	1,610,000	1,610,000	70
Koppers Co. Kobuta, Pa.	Styrene monomer	320,267	320,267	70
Dow Chem. Co. Midland, Mich.	Methyl styrene	10,241,000	10,241,000	60

Some of the above capacity is scheduled to come in this year. The methyl styrene has been announced by Dow as vinyl toluene which is similar to vinyl benzene or regular styrene. Reportedly it can be used for polystyrene in many applications. It has the advantage of using toluene instead of benzene as a base material, but the Petroleum Defense Administration remarks that toluene is going to be just as tight as benzene because so much of it is needed for TNT and other defense products.

Methyl styrene has been experimented with for several years by various companies. When polymerized it has several superior properties, but production cost has heretofore been quite high. Dow has apparently licked that problem; at least, the amount of their investment would indicate the extent of their confidence.

A cry has gone up again about the possible polystyrene shortage in June and July because of the benzene requirements of the Government's increased rubber program. Past experience, however, leads us to guess that polystyrene production in June will be close to the usual 20 million lb. figure which the industry has been getting practically every month this year. In fact, all indications are that production volume so far this year has been greater than in 1950.

Melamine

Melamine has been scarce ever since last summer and there is no prospect for relief until a new plant comes in next fall. The shortage is due more to lack of facilities than to lack of raw materials.

There have been heavy DO orders for dishware, industrial electrical moldings, and melamine-glass laminates for electrical panel boards and aircraft ignition. Melamine buttons for Service uniforms and underwear have also cut heavily into the available supply. Several hundred thousand lb. of melamine have also gone into V-boxes and wet-strength paper for the Services.

The amount of melamine available for decorative laminates is now about the same as in the first quarter of 1950, or quite a bit less than was used for the same purpose in the last quarter. Laminators point out that last year's high production of 72 million lb. of phenolic resin for laminates included far more decorative than ever before, and that for every 2 lb. of phenolic used for that purpose, 1 lb. of melamine was required.

An authority on plastic-glass combinations has recently pointed out that good progress is now being made in experiments with low pressure melamine-glass combinations. The goal is for production at less that 100 p.s.i. The electrical and flame resistant properties imparted by melamine would considerably broaden the base for possible uses of plastic-glass combinations.

Urea molding powder is reported to be just about in balance. Orders are said to be in a slight decline but the backlog is large enough to keep suppliers busy. Up until a year or two ago, capacity was not much over 30 million lb. a year; present capacity is 40% more. The only raw material problem at the moment is formaldehyde, and the effect of this problem on urea producers is dependent upon their contractual arrangements.

MODERN PLASTICS

VOLUME 28 JULY 1951 NUMBER 11

BIG INJECTION MACHINES — What are they doing?

IN 1945, the B-29 Superfortress was considered a "mammoth" bomber. But less than two years later the advent of the B-36 had demoted the B-29 to the status of a medium bomber. Just about the same thing has happened in the field of large injection molding machines since the first 60-oz. machine was delivered less than two years ago. And, just as the B-36 changed the whole scope of strategic bombing by bringing new targets within reach, the introduction of injection machines with capacities up to 300 oz. has enabled custom molders to set their sights on applications which were once out of the question for thermoplastics.

A five-pound battery case and a 72-oz. refrigerator inner door 34 by 34 in. have been in production for some time. A one-piece styrene television cabinet weighing 6 lb. and a 5½-lb. refrigerator door liner with an area of 1025 sq. in. have been molded experimentally. Production molds are being built for a line of molded styrene caskets and for a one-piece styrene clothes hamper. And responsible molders are seriously talking about molding kitchen cabinets (Fig. 1), one-piece refrigerator interiors (Fig. 2), cocktail tables and other furniture (Fig. 3), wash basins (Fig. 4), and even bathtubs!

What are the machines which made this revolution possible? Where are they, and what are they doing? What are they likely to be doing in the near future?

The Machines

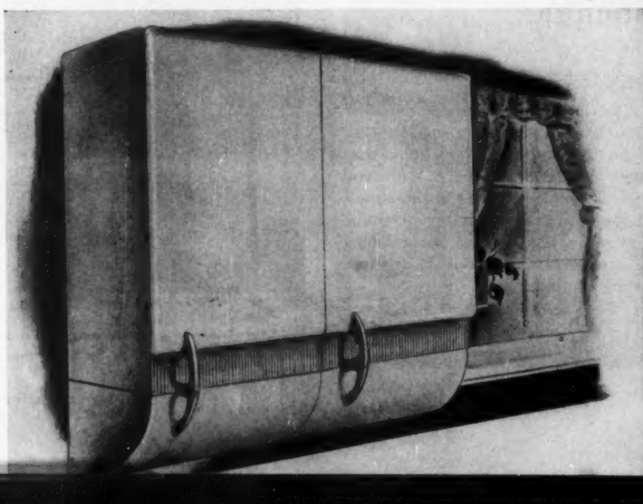
Just one year ago, when MODERN PLASTICS surveyed the field of large injection moldings[1], a 48-oz. machine was considered really big—and less than 15 molding plants in the country had such machines or larger ones in operation. Today there are 54 injection molding machines rated at 60 oz. or more in operation in 31 different plastic molding plants. And nine of those

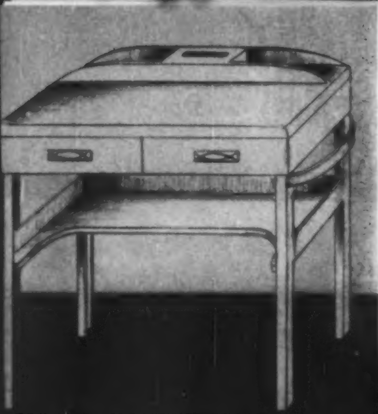
[1] "Thermoplastic Big Shots," MODERN PLASTICS 27, 55 (July 1950).

Fig. 1—One possible application opened to thermoplastics by the development of big injection molding machines is kitchen cabinets complete with molded-in racks, handles, shelves

Fig. 2—One-piece refrigerator interior with molded-in shelf supports could be produced

Drawings courtesy Amos Molded Plastics





Drawing courtesy Ideal Plastics Corp.

Fig. 3—An easy-to-clean dressing table for the bath room could be injection molded of styrene

Drawing courtesy Amos Molded Plastics

Fig. 4—Wash basins made of plastic would be colorful, light in weight

54 machines are capable of injecting 200 oz. or more!

The large machines in operation include 60-oz. machines built by The Hydraulic Press Mfg. Co., Mount Gilead, Ohio; The Watson-Stillman Co., Roselle, N.J.; and Reed-Prentice Corp., Worcester, Mass.

The next step up the scale of rated capacity is an 80-oz. machine made by Jackson & Church Co., Saginaw, Mich. Then comes the 85-oz. Watson-Stillmans.

In the 100- to 199-oz. range, there are 110-oz. Jackson & Church machines and 120-oz. Watson-Stillmans. In addition to these, Improved Paper Machinery Corp., Nashua, N.H., has recently announced a preplasticizer unit which will convert its 48-oz. machine to 150 ounces.

Machines rated at 200 oz. are also made by Jackson & Church and Watson-Stillman. The latter is a modified 60-oz. machine fitted with a preplasticizer unit. H.P.M. has also produced a 200-oz. injection machine which makes use of a special preplasticizer designed to reach that capacity[2].

The largest capacity machine in existence at the time of this writing is the 300-oz. Watson-Stillman model which is the company's 85-oz. machine with a preplasticizer unit and other modifications.

In addition to the standard machines listed above, there are the large capacity vertical transfer-type injection machines which were described in these pages last year[3]. These special machines, made by Mack Molding Co. Inc., for its own use, have been in operation for some time. There are eight such large machines, one rated at 60 oz., three at 100 oz., and four at 200 ounces.

As of the middle of May, the large machines in actual operation in molding plants in this country[4] could be classified as follows:

60 oz.	34
80 to 85 oz.	3
100 to 120 oz.	8
200 oz.	7
300 oz.	2

But these figures are constantly changing. Additional large machines are being installed—and some of those already in molding plants are being fitted with preplasticizer units to increase their capacity. It is likely that by the end of 1951 many of the machines now classified as 60's will be running as 200's.

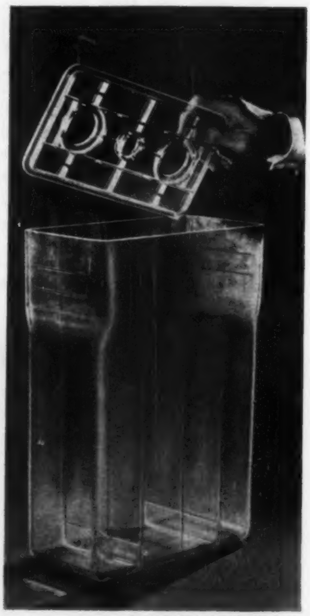
What They Are Doing

The large machines are so new and the fields they can serve are so unfamiliar to custom molders that there has not yet been sufficient time to sell the services of these machines to a fraction of the potential end users. The selling process has, of course, been retarded by materials shortages.

As a result, most of the jobs now running on the big machines are simply larger versions of established applications rather than new and startling applications made possible by the large machines. Most of the big machines are turning out refrigerator parts, television masks, battery cases, and display racks. And comparatively few of these parts even approach the full capacity of the machines they are running on.

In fact, many molders are using their 60-oz. and larger machines to turn out pieces which could be and have been molded on 48-oz. and smaller machines. These molders, plagued by materials shortages and up to their ears in orders which they cannot fill with their small machines, are too busy to do the spadework and plugging which would be necessary to sell 60-oz. jobs. Such jobs can well wait until materials are more available.

But despite these handicaps, the big machines have turned out some jobs which indicate the trends quite clearly and which make the "big shots" discussed in these pages just one year ago[1] look small. The big



Courtesy Mack Molding Co., Inc.

Fig. 5—Styrene battery case weighs 5 lb., is 10¾ by 15½ by 5⅝ inches

[2] See p. 99, this issue.

[3] "Accumulator-Operated Injection Machine," Modern Plastics 27, 79 (Aug. 1950).

[4] H.P.M. has shipped one 60-oz. machine to Italy and Watson-Stillman has shipped one to France.

machines have proved themselves capable of successfully and economically producing heavier pieces than have ever before been produced, pieces with greater projected area, and sometimes (although some molders will debate this) multicavity shots of smaller pieces.

Heavier Pieces

As far as can be determined, the largest piece which has ever been injection molded on a production basis is a 12-lb. clear acetate piece molded by Mack Molding Co., Inc., on one of its specially-built 200-oz. machines. The piece, which is generally cylindrical in shape and is about 18 in. in diameter, is produced for the government, and the details of its appearance and end use are highly classified.

The next heaviest piece on record is a styrene battery case (Fig. 5) molded by Mack for C & D Batteries, Inc., Conshohocken, Pa. This piece weighs 5 lb., measures 10¾ by 15½ by 5⅝ in., and has a 5/16 in. wall section. Another one-piece battery case (Fig. 6) molded by A. L. Hyde, on a 200-oz. Watson-Stillman machine, weighs 4¼ pounds. This clear styrene piece, molded for The Electric Storage Battery Co., Philadelphia, Pa., has molded-in partitions dividing it into three compartments. Still another battery case, weighing 4 lb., is being molded on a 110-oz. Jackson & Church machine by Chicago Molded Products Corp.

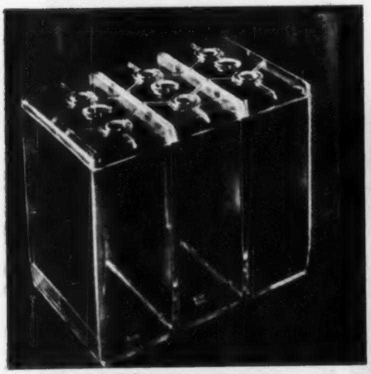
A battery job which has become a classic application is the styrene case molded in two halves by Prolon Plastics Div., Pro-phy-lac-tic Brush Co. This battery won the award in the Industrial and Machinery classification of the Seventh MODERN PLASTICS Competition in 1948[5]. Each half is molded in a 5-lb. gross weight shot.

This job was originally run on a 16-oz. Lester machine fitted with a special preplasticizer unit designed by Prolon and built by Watson-Stillman. This unit, according to Prolon, was the forerunner of the first Watson-Stillman preplasticizer units, the predecessors of the units which are a part of Watson-Stillman's 200- and 300-oz. machines. Prolon is now running the battery halves on a 120-oz. Watson-Stillman, and the 5-lb. shot still ranks among the largest injection molding jobs.

Other than battery cases, the largest injection molded piece produced seems to be a bowl for a frozen orange juice machine, molded of clear high-heat resistant acrylic. This piece (Fig. 7) weighs 4½ lb. and is molded on a 200-oz. Watson-Stillman machine by A. L. Hyde for The Oiljak Mfg. Co., Inc., Montclair, N.J.

One of the heaviest refrigerator parts being injection molded is a 54-oz. styrene tray produced for Norge by Erie Resistor Corp. on a 60-oz.

[5] "Award to The Electric Storage Battery Co.," MODERN PLASTICS 26, 137 (Sept. 1948).



Courtesy A. L. Hyde

Fig. 6—Three-compartment transparent styrene battery case molded on 200-oz. injection machine weighs 4¼ pounds

Fig. 7—Bowl for frozen orange juice machine is molded of clear high heat-resistant acrylic. It weighs 4½ pounds

Courtesy A. L. Hyde

Where the Big Machines Are Working

As of the end of May, injection molding machines rated at 60 oz. or more were in actual operation in the following molding plants:

Amos Molded Plastics Div., Amos-Thompson Corp., Edinburg, Ind.

Associated Plastic Companies, Inc., Chicago, Ill.

Bridgeport Moulded Products, Inc., Bridgeport, Conn.

Cambridge Molded Plastics Co., Cambridge, Ohio.

Chicago Molded Products Corp., Chicago, Ill.

The Cincinnati Advertising Products Co., Cincinnati, Ohio.

Consolidated Molded Products Corp., Scranton, Pa.

Continental Can Co., Inc., Cambridge, Ohio.

Cruver Manufacturing Co., Chicago, Ill.

Erie Resistor Corp., Erie, Pa.

Federal Tool Corp., Chicago, Ill.

General American Transportation Corp., Chicago, Ill.

General Electric Co., Decatur, Ill., and Taunton, Mass.

General Machine & Tool Works, Inc., Walled Lake, Mich.

General Products Co., Central Falls, R. I.

Ger-Ell Mfg. Co., Chicago, Ill.

A. L. Hyde, Grenloch, N. J.

Ideal Plastics Corp., Hollis, L. I., N. Y.

Loma Plastics Inc., Fort Worth, Tex.

Mack Molding Co., Inc., Wayne, N. J. and Arlington, Vt.

Makray Mfg. Co., Chicago, Ill.

Nosco Plastics Div., National Organ Supply Co., Erie, Penn.

Panelyte Div., St. Regis Paper Co., Newark, N. J.

Prolon Plastics Div., Pro-phy-lac-tic Brush Co., Florence, Mass.

Rona Plastic Corp., Bronx, N. Y.

Santay Corp., Chicago, Ill.

Sheller Mfg. Corp., Portland, Ind.

Victory Mfg. Co., Chicago, Ill.

The Watertown Mfg. Co., Watertown, Conn.

Courtesy Santay Corp. and The Hydraulic Press Mfg. Co

Fig. 8—Styrene window which weighs 50 oz. is one of the heaviest television parts now being injection molded. Operator is shown removing the part from the 60-oz. machine

Watson-Stillman. Another crisper tray of about the same weight is molded by Amos Molded Plastics on its recently installed 300-oz. Watson-Stillman. Many other molders are running refrigerator parts ranging from 25 to 40 oz. on 60-oz. machines—but most of these pieces could be run on 48-oz. machines if enough of them were available.

One of the heaviest television parts being injection molded is a 50-oz. styrene window (Fig. 8) molded by Santay Corp. on a 60-oz. H.P.M.

Another heavy piece which should be mentioned is a 25½-in. diameter styrene Christmas wreath weighing 3½ pounds. This piece is molded for Noma Electric Corp. by Prolon on a 120-oz. Watson-Stillman.

Before leaving the subject of heavy pieces, it would be well to mention that there have been many pieces which weigh more than the rated capacity of the machines on which they are molded. For example, the Plastics Div., Nash-Kelvinator Corp., Milwaukee, Wis., has produced many parts which weigh more than 40 oz., the rated capacity of the largest machine in the plant.

One example is an ice cream cabinet lid which weighs 49.1 oz. and measures 22¾ by 11⅜ by 1 ³⁄₁₆ inches. This part is molded of a styrene copolymer material on a 40-oz. Watson-Stillman. The wall section of the part in places approaches ½ inch. This necessitates a somewhat long time to cool the piece in the mold, which allows plenty of time for plasticizing the required amount of material in the 40-oz. chamber.

Large Area Pieces

The common practice of referring to injection machines by their rated capacity often gives rise to the general impression, if not the actual belief, that the weight of a piece determines the size machine on which it should be run. Weight is of course of primary importance—but it is far from being the only consideration. Sometimes a piece which does not approach 60 oz. in weight must be molded on a 60-oz. or larger machine simply because no smaller machine has sufficient platen area to accomodate the mold for the part. In other cases, the deciding factor is

tesy Midland Die & Engraving Co.

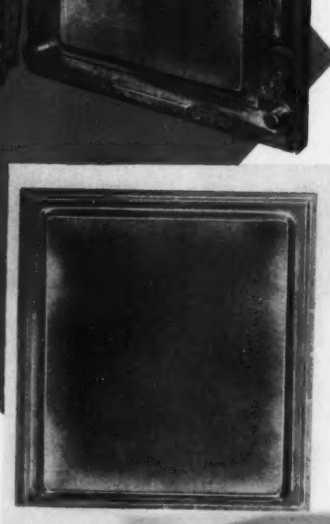


Fig. 9—Largest area piece being injection molded is styrene refrigerator inner door 34 by 34 in. which weighs 72 oz. Part is shown at right, mold for the part above

Courtesy Prolon Plastics

the clamping pressure required by a large area piece.

As far as MODERN PLASTICS can determine at the time of this writing, the largest area piece being injection molded on a production basis is a refrigerator inner door 34 by 34 in. with a ⅛ in. wall section (Fig. 9). The piece, which weighs over 72 oz., is being molded of styrene by Prolon on a 120-oz. Watson-Stillman in a mold made by Midland Die & Engraving Co., Chicago.

Many other refrigerator parts being run on the big machines are being made on those machines because of their large area rather than their weight. A one-piece Crosley breaker frame 29¾ by 47 in. with a wall thickness of 0.100 in. is being molded by General American Transportation Corp. The piece, which weighs 35 oz., is molded on an 85-oz. Watson-Stillman at the rate of about 55 shots per hour. The same molder is also producing a 52- by 28-in. breaker frame (Fig. 10) which weighs 34 oz. on a 60-oz. H.P.M. A trim frame 41¾ by 23¼ in. which weighs 27 oz. is being molded of high impact styrene by Cambridge Molded Plastics Co. on a 60-oz. Watson-Stillman.

Another type of refrigerator part which is being turned out by the larger machines is an evaporator baffle. One baffle, 18 by 24 in. and another, 15½ by 24, are being molded by General American Transportation on 60-oz. H.P.M. machines (Fig. 11). Each of these consists of a top and a bottom piece which are cemented together with insulation between them. A baffle 23½ by 15½ which weighs 38 oz. is being molded for Crosley by Cambridge on a 60-oz. Watson-Stillman.

Outside of the refrigerator field, one example of a large area injection molded piece is the front panel for a General Electric air conditioner. This piece (Fig. 12) measures 27 by 13 in., is 2 in. deep, and has a ⅛-in. wall section. The piece is run in either styrene or acrylic, and weighs 33½ oz. in the latter material. It is molded on a 60-oz. H.P.M. in G.E.'s Taunton, Mass., plant. The panel has three 6½-in. diameter holes molded-in to accomodate rotating louvers, and the piece is disk-gated in the center hole with a restricted gate around the circumference of the hole.

One piece which measures only 14¼ by 13½ by 4 in. and weighs only 23 oz. is being molded on a 60 oz. Watson-Stillman in order to get sufficient platen area to allow the movement of cams on all four sides. The piece (Fig. 13), a drip pan for a dehumidifier, is molded by Continental Can Co., Inc., for Seeger Refrigerator Co., Evansville, Ind. It has two rectangular openings 4¾ by 1⅞ in. molded-in to each side on a 10° angle. The bottom of the piece also has a molded pipe thread connection which has two right-angled partitions inside of this connection.

The mold has four cam sections which move about 1¼ in. and are automatically actuated by tool steel cam pins. The mold also has two interchangeable loose lugs which are used to form the threaded pipe connection, and the piece is gated through these lugs by the use of a 14-in. long nozzle. The mold was built by Akromold, Inc., Akron, Ohio.

Multi-Cavity Dies

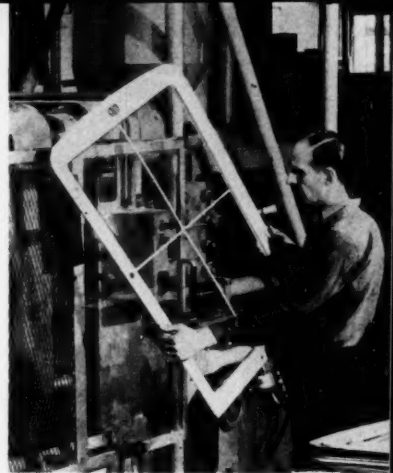
All of the foregoing pieces were molded on the large machines in single-cavity dies. Although some multi-cavity work has been done successfully with these machines, molders seem to be sharply divided on the question of whether it is wise to make such use of a big machine. A full discussion of this phase of large injection molding demands more space than is available here. Multi-cavity work in large injection machines will therefore be discussed in a separate article in an early issue of MODERN PLASTICS.

The Future

As the foregoing survey indicates, the big machines have virtually revolutionized injection molding in less than two years. But the things the machines have done are only a small fraction of what they can and will do.

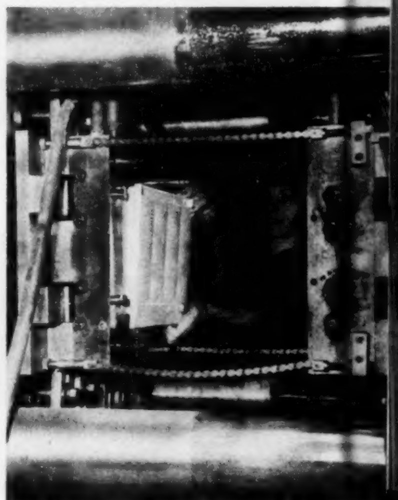
There already is a 5-lb. battery case being molded. But General American Transportation is tooling up to run one which will measure 12 by 8 by 14 in. and weigh about 9½ pounds.

A refrigerator door liner weighing 72 oz. is already in production. But Jackson & Church has molded an 89-oz. door liner (Fig. 14) on an experimental basis on its 200-oz. machine. One molder is tooling up to mold a 32- by 47-in. liner weigh-



Courtesy The Hydraulic Press Mfg. Co.

Fig. 10—Breaker frame 52 by 28 in. is molded of styrene on 60-oz. machine

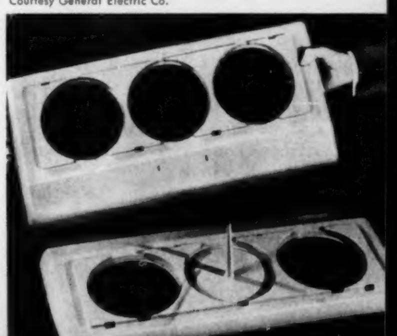


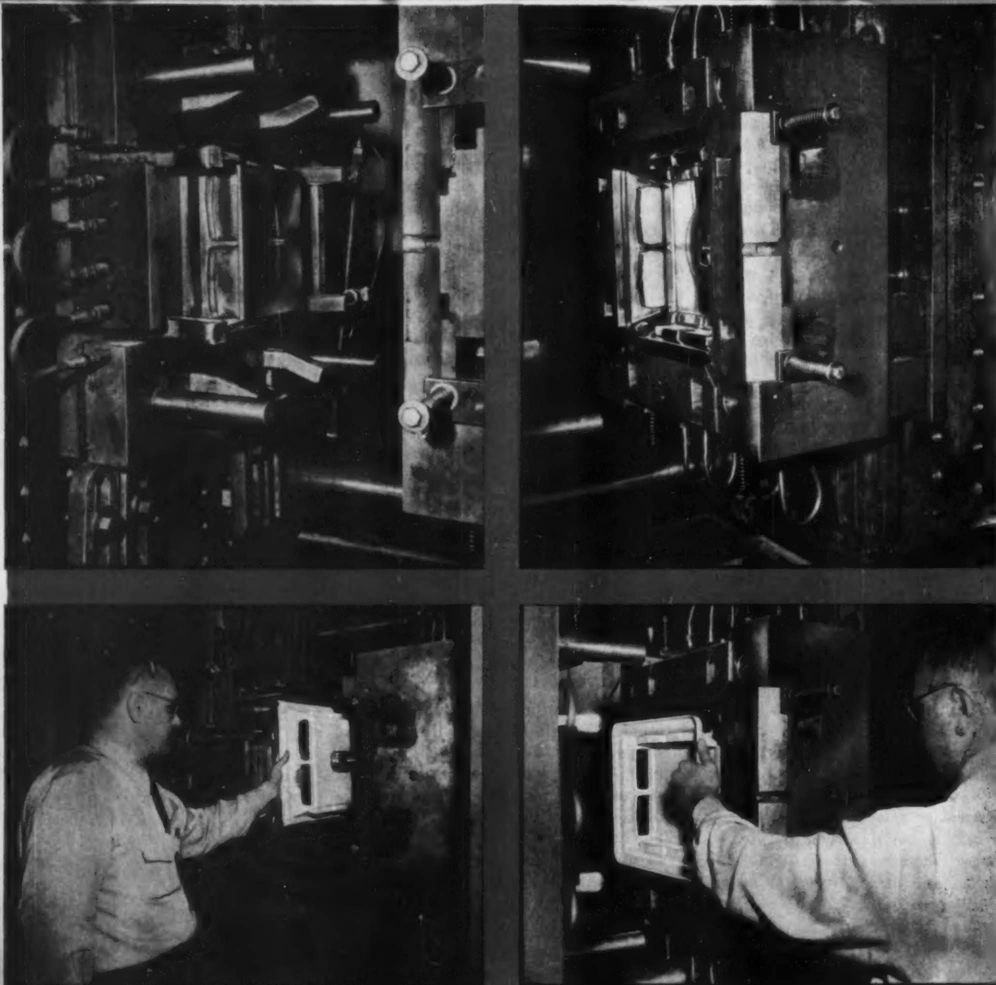
Courtesy General American Transportation Corp.

Fig. 11—Refrigerator evaporator baffle 18 by 24 in. is molded on 60-oz. machine

Fig. 12—Front panel for air conditioner is 27 by 13 by 2 in., weighs 33½ ounces

Courtesy General Electric Co.





Photos courtesy Continental Can Co., Inc.

Fig. 13—Drip pan for room dehumidifier weighs only 23 oz. and measures 14½ by 13½ by 4 inches. But the design of the part necessitated cams on all four sides of the mold. The piece thus had to be molded on a 60-oz. machine to get sufficient platen area to accommodate the die. The eight rectangular side openings in the piece are molded by the use of cams which move about 1½ in. and are actuated by core pins (visible in picture of male half of mold, top left). The mold also has two interchangeable loose lugs which are used to form the threaded pipe connection, and the piece is gated through these lugs by the use of a 14-in. long nozzle. One of the lugs is visible on the part being removed from the mold (lower left). The lugs fit into a depression in female part of mold (top, right)

ing 80 oz. for a leading refrigerator manufacturer.

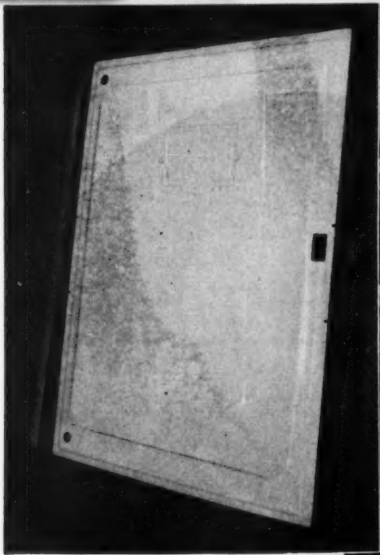
A compression mold for a television cabinet has been converted to run in a 200-oz. Jackson & Church machine in the G. E. Decatur plant, and has turned out an experimental styrene cabinet (Fig. 15) which weighs 6 pounds.

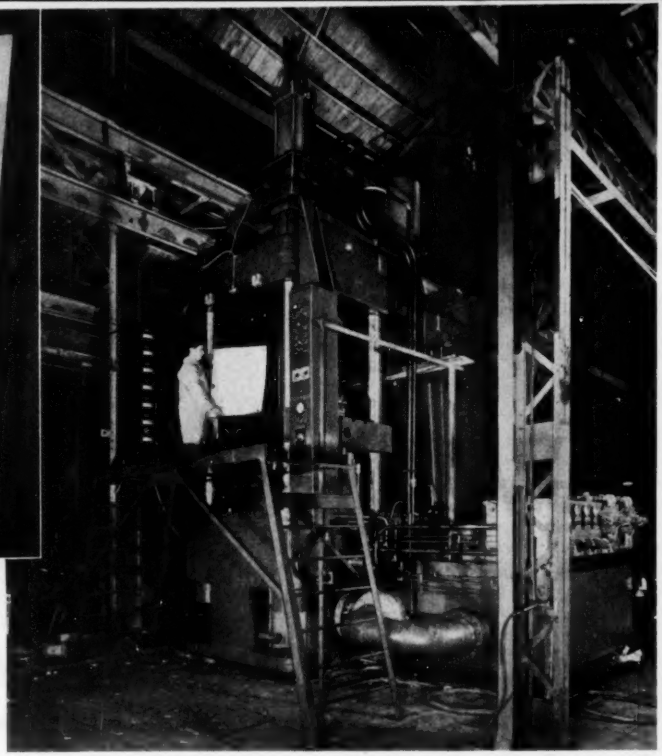
Production molds are being built for many other large parts. For example, Rona Plastic Corp. is now tooling up to mold styrene caskets and a one-piece clothes hamper.

Looking even further ahead than the jobs now in process, the possible jobs for the big machines seem infinite. Many of the possibilities will not become probabilities until some of the properties (particularly dimensional stability and impact strength) of existing thermoplastic materials have been improved—but it is not far-fetched to believe that those improvements may soon be forthcoming.

In the refrigerator field, one-piece door liners and breaker strips are already realities—and larger ones are a logical development. A one-piece molded *interior* for a refrigerator, complete with molded-in shelf supports, is a distinct possibility (Fig. 2).

The big machines will undoubtedly be used to mold housings





Photos courtesy Jackson & Church Co.

Fig. 14—Refrigerator door liner which weighs 89 oz. (above) was molded experimentally on 200-oz. Jackson & Church machine shown at right in machinery manufacturer's plant with temporary platform set up at what would be floor level in a permanent installation

and cabinets of various types. Television cabinets are one possibility—when television set sales recover from their present slump. The front panel for an air conditioner is already being molded; complete air conditioner cabinets may be next.

Plumbing fixtures, such as toilet bowls, basins (Fig. 4), and even bathtubs are an intriguing possibility. Amos Molded Plastics, which has already highlighted this possible development in its advertising and sales literature, points out that a plastic toilet bowl assembly and float tank (less hardware) would weigh about 18 to 20 lbs., as against 110 lbs. for the same units in presently used materials.

Bathroom medicine chests and kitchen cabinets (Fig. 1) with integrally molded handles, shelf supports, racks, or even shelves could also be injection molded.

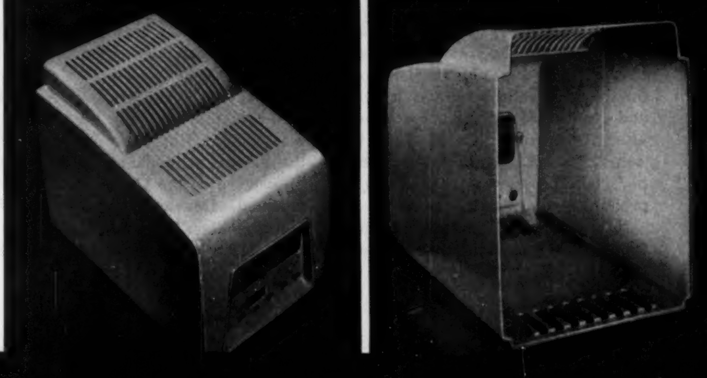
Injection molded occasional tables and other pieces of furniture are another possibility. Ideal Plastics Corp., is drawing plans for molded furniture (Fig. 3). This same company is now completing the installation of a number of large machines, including several with 300-oz. capacity. These will boost the company's available molding units from 73 to over 100, making Ideal's plant the largest one available for custom molding in the world.

What else can the big machines produce? The list includes large acrylic signs of the type now fabricated for gas stations, luggage, acrylic aircraft canopies, washing machine tubs, desk drawers, large light fixtures, and so on.

All this can be done on the machines already in existence. And meanwhile, the machinery manufacturers are going ahead with plans for colossal injection machines which will put even the 300-oz. machine into the medium size class. Jackson & Church is talking about a 500-oz. machine with an 8-ft. square platen, 4000-ton clamp, and 140-in. daylight. Watson-Stillman thinks that the next step will be a machine with a capacity of 750 to 1000 ounces. A thousand ounces is 62½ pounds! Wow!

Fig. 15—Styrene television cabinet which weighs 6 lb. was molded in a converted compression mold on a 200-oz. Jackson & Church machine. The piece was produced as an experiment. Such cabinets would not be practical in thermoplastic without a complete redesign

Photos courtesy General Electric Co.



HYATT AWARD

© Fabian Bachrach

JAMES BAILEY

THE John Wesley Hyatt Award for distinguished achievement in plastics was presented to James Bailey at The Greenbrier, White Sulphur Springs, W. Va., on May 24th. Mr. Bailey received the 1950 Hyatt gold medal and $1000 for research in techniques and development of machinery for the extrusion of thermoplastics. The Honorable Okey L. Patteson, governor of West Virginia, presented the award on behalf of the John Wesley Hyatt Award Committee at a banquet at which Horace Gooch, Jr., president of The Society of the Plastics Industry, was toastmaster.

Mr. Bailey, who is vice president and director of research for Plax Corp., was cited for developing techniques for the production of polyethylene bottles, the continuous extrusion of flexible styrene sheet, and the extrusion of cellulose plastics and polymeric resins in continuous rod form.

Under his direction, work was begun in 1937 on a commercially practical process for blowing plastic bottles. Early experiments were conducted with cellulosics and styrene, and continued with polyethylene after its introduction. By 1950 the unbreakable polyethylene bottle had become a major commercial product of the plastics industry.

New techniques developed by Mr. Bailey for extruding styrene permit the manufacture of sheets in which the molecules are oriented in two directions, giving a high degree of toughness and flexibility to a product that was formerly brittle and relatively unusable.

Mr. Bailey was responsible for the "lubo-film" method of extruding high-density rods in continuous lengths. This process, which has been applied to a number of plastics, results in the absence of bubbles and maintains close tolerances without subsequent grinding, permitting greater production speeds.

As early as 1939, Mr. Bailey and his associates developed techniques for the continuous extrusion of thermoplastic sheet from cellulose acetate molding powder without employing the conventional solvent, calendering, or cast methods.

Mr. Bailey was born in Gowanda, N.Y., and attended grammar and high schools in Gowanda; Washington, D.C.; Brooklyn, N.Y.; and Bethlehem, Pa. After graduating from Lehigh University in 1912 with the degree of Mechanical Engineer, he worked in the Ceramic and Mechanical Development Depts. of Corning Glass Works.

In 1929 he organized Bailey & Sharp Co., consulting engineers and glass technologists, and in 1937 joined the staff of Hartford-Empire Co. Shortly thereafter he was transferred to the newly-formed plastics division, Plax Corp., as director of research.

Mr. Bailey is the recipient of the tenth John Wesley Hyatt Award which is sponsored by Hercules Powder Co. to honor Hyatt, father of the plastics industry. It was Hyatt's work with cellulose nitrate and camphor in 1867 which resulted in the making of the first thermoplastic, Celluloid.

Award Committee

Members of the 1950 Hyatt Award Committee are: Richard F. Bach, consultant in industrial art, Metropolitan Museum of Art; Dr. N. Howell Furman, president, American Chemical Society; Mr. Gooch; Waldemar Kaempffert, science editor, *The New York Times;* George Braxton Pegram, vice president emeritus, Columbia University; George M. Powell, III, Union Carbide and Carbon Corp. and 1949 award medalist; and Dr. Edward R. Weidlein, director, Mellon Institute of Industrial Research.

Adhesives May be the Answer

Many problems inherent in the design and assembly of plastics products may be solved by an intelligent approach to the use of adhesives

by GORDON P. HOLLINGSWORTH *

EVEN the "impossible" in plastics fabricating and assembly operations can sometimes be done by the proper use of industrial-quality adhesives and sealers. One case in point is the manufacture of a plastic window screen which lifts into place when the window is raised, but which automatically coils up below the sill when the window is lowered.

The design of this screen required that the sides of the plastic screening be fastened to narrow coils of spring steel, one coil on each side. The screen-to-coil joint had to be *permanently flexible* to permit frequent coiling and uncoiling; *continuous* to prevent the screen from gapping away from the coil; and *resistant* to outdoor weathering, including salt-laden atmosphere of coastal communities, plus normal sun and rain and wide temperature variations.

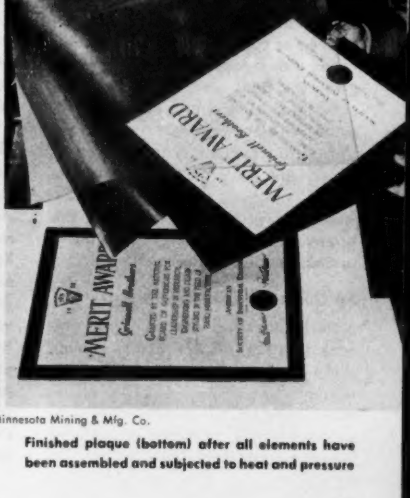
To meet those requirements, as well as the requirement of efficient production-line assembly, engineers chose a quick-drying solvent-type synthetic adhesive that had unusually high adhesion to metal and plastic, and that was transparent, since the joint would be exposed to view when the screen was raised. The adhesive was one that provided excellent resistance to weathering and that retained its high-strength bond at temperatures from −70 to 250° F.

Typical of other jobs which adhesives are doing is the more common attaching of plastic nameplates to refrigerator doors without puncturing the door; or the attaching of a steel clip to high-pressure plastic laminate in such a manner that the surface of the laminate remains unmarred.

Adhesives and sealers can also be expected in many instances to reduce production costs or to improve the end product, or both. This does not infer, of course, that adhesives should necessarily be considered to the exclusion of other fastening means. There are many examples of excellent plastic-to-plastic bonds accomplished without special adhesives, and other cases in which adhesives and mechanical fastenings are used together to do a job that neither could do alone. But adhesives and sealers have proved themselves in many phases of plastics manufacturing; as their use becomes better understood, they will undoubtedly be used much more widely and effectively.

The American Society of Testing Materials defines an adhesive as a

* Technical Service Manager, "3M" Adhesives & Coatings Div., Minnesota Mining & Manufacturing Co., St. Paul, Minnesota.



All illustrations courtesy Minnesota Mining & Mfg. Co.

Spraying a "fog" coating of solvent-type adhesive on plywood backing in the manufacture of plastic-covered plaques. Later, printed matter and then vinyl covering sheet will be applied

Finished plaque (bottom) after all elements have been assembled and subjected to heat and pressure

In one version of wicking pad method for applying adhesive, plastic screen is placed over tray holding adhesive-saturated glass wool

Initial phase in fabricating polystyrene freezer baffle: plastic part is pressed to wicking pad, thus receiving thin film of adhesive on the edges

"substance capable of holding materials together by surface attachment." That fact—that adhesives unite materials by surface attachment—is what gives adhesives some of their striking advantages for plastics work, of which three should be emphasized:

1) An adhesive distributes stress evenly over the areas to be joined. This is especially important if unusual stress is expected, or if one of the surfaces is inherently weak, as in the case of glass wool.

2) An adhesive seals at the same time it adheres, thus providing a moisture-proof bond between, for example, parts of a plastic insulating shelf in a refrigerator.

3) An adhesive eliminates the need for piercing thin materials, or piercing the sub-surfaces of thicker units.

An adhesive might be further explained as consisting of two portions, solid and liquid. The solid portion gives the final assembly such characteristics as strength, adhesiveness, color, resistance to water, aging, etc. The liquid portion is the means by which the solid part is put into a useful position; it influences the speed of wetting, the wet odor, the viscosity, the handling characteristics, and similar properties.

No Universal Adhesive

Perhaps most important in any consideration of the use of adhesives is a recognition of the fact that no one adhesive will do all jobs. Instead, hundreds of adhesives are available, each designed to do certain types of jobs best.

However, despite the number of adhesives, choosing the right one for a particular job need not be difficult. It is simply a matter of describing the job to be done and the service conditions to be met, and inviting a qualified engineer to recommend the proper adhesive on the basis of that description.

The description of the job and the expected service conditions should be reasonably detailed. There are, for example, a number of adhesives for bonding plastic to plastic. What kind of plastic? (Some adhesives are far more effective with certain plastics than with others.) What are the approximate weights and dimensions of the units to be joined? What is the size of the bonding area? What stresses should be expected in service? What about other service conditions, such as temperature, moisture, shock, and weather? And how would you want to apply the adhesive—by brush? spray? dip?—to best fit your particular production line?

Applying Adhesives

Even after a given adhesive has been put into use, the plastics fabricator, after personal experience, may find ways in which to improve his use of the material. A better method of applying adhesive for a particular job, for example, was developed by the Plastics Div., The Standard Products Co., at the firm's plant in St. Clair, Mich. An adhesive had been selected to hold polystyrene to polystyrene in the fabrication of freezer compartment doors and baffles for home refrigerators. Both the door and the baffle consisted of front and back parts with glass wool insulation bats to be sandwiched between the parts.

The parts of the plastic door were designed to be joined with a thin solvent-type synthetic resin adhesive, without mechanical fastenings. In contrast, the parts of the baffle were designed to use screws as the primary fastening, with the adhesive sealing the joint and the screw holes, thus protecting the enclosed glass wool against moisture vapor.

The method which the firm developed for applying the adhesive consists of adopting the principles of the wicking pad. A section of 1-in. thick glass wool is placed in a shallow metal pan and covered with a plastic screen. The adhesive is then poured into the pan; it rises to the surface of the screen by capillary action.

The plastic part to be adhered to the door (or the baffle) is then lightly pressed against the plastic screen—simply touched firmly against the screen and lifted—and then placed in position. Where screws are used, they are applied immediately, and the adhesive sets as the unit moves along the production line. Where the adhesive is used without screws, the unit is placed under 10 to 40 lb. pressure (depending on the unit) for a short time to complete the bond.

The wide variety of jobs that adhesives are doing in plastics manufacturing can be indicated by comparing the operations of almost any two plastic plants. In contrast with operations at Standard Products,

After insulation pad is correctly positioned for assembly, operator places the adhesive-coated part in contact with the main part of the freezer baffle

With adhesive-coated parts placed in position by hand as shown, freezer baffle assembly is ready to be subjected to pressure

for example, is the use of adhesives by Acme Laminating and Plastics Co., Hazel Park, Mich. This latter firm makes plastic-covered plaques and advertising displays, and laminates business cards, identification cards, and advertising reprints between plastic sheets.

The plaques and displays (up to 10,000 items a month) are mounted on plywood or other backing material, with a clear plastic sheet covering the face of the display.

Production of a finished piece consists of: 1) Spraying a "fog" coating of the solvent-type adhesive on the backing and allowing 3 min. for air-drying. Approximately 50,000 sq. in. are sprayed from 1 gal. of the adhesive, mixed 50-50 with a thinner. 2) Laying the printed material on the board and placing the plastic sheeting on top. 3) Subjecting the assembly to heat and pressure (275 to 300° F., at about 400 p.s.i.). The heat and pressure improve the adhesive bond between the printed material and the board, and bonds the edges of the plastic sheet to the board. 4) Sawing the boards into units of one display each, and sanding and bevelling the edges.

Defects Eliminated

Another example of the possibilities of adhesives is the use of an industrial synthetic rubber adhesive at Brunswick-Balke Collender Co. plant in Detroit, Mich., where Mineralite plugs are installed in Brunswick bowling balls of the same material. The plug takes the place of the old finger holes, and permits drilling new finger grips, when a bowler wants a "personalized" ball.

Previously the plugs were installed with pitch, which required four to five days curing time in presses—and which, more important, resulted in a bond that was not entirely free of defects. With the special adhesive, the use of presses has been eliminated; drying time has been reduced to overnight; defects have been eliminated; and the plugs never fly out of the ball during buffing. The adhesive is applied with a spatula.

Another adhesives job typical in plastics manufacturing is the joining of a non-rigid plastic to a rigid surface. An example is the fabrication of shipping crates for export use. Fibrous plastic insulation is bonded to the inside of a wood crate with an adhesive, thus accomplishing two purposes: 1) distributing the stress of the "grip" on the fibrous insulation material over its entire surface, instead of at separate points from which it might tear loose; and 2) providing a moisture-proof seal between the crate and the insulation.

Among the wide variety of other uses for synthetic resin and synthetic rubber adhesives in plastics manufacturing are such applications as: the use of a transparent adhesive for laminating two transparent films together in making plastic bags and similar containers; the use of adhesive in installing plastic knobs, sometimes involving both an adhesive and screw threads for maximum strength in the joint; the use of adhesives to bond rubber tubing inside plastic tubing in some types of hose manufacturing; and the attaching of large plastic letters to display cases and to store fronts of glass, clay, or steel.

Another variety of adhesive is used in plastics assembly operations involving bonding of acrylic to metal channels. For operations such as this a special 100%-solids synthetic rubber adhesive is usually used—an adhesive that cures chemically to a tough rubbery solid, that does not need heat, pressure, or accessibility to air to effect a cure, and that does not shrink in curing.

Those adhesives applications, already widely adopted and typical of many others, are indicative of the variety of possibilities that still exist for the use of adhesives in solving problems in plastics fabrication.

Special synthetic adhesive holds bowling ball plug firm, reduces drying time

Decorating step in production of flexible vinyl film laminate. Conventional decals are removed from their paper backings and placed in position on face of bottom film

Placing transparent top sheet of film over decorated lower sheet, prior to laminating step

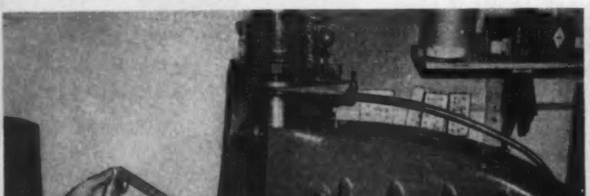
EMBEDMENTS SEALED IN FLEXIBLE FILM

HUGE new markets for a number of applications of vinyl film and flexible sheet are foreseen as a result of recent development work in the lamination of highly plasticized material. These applications take advantage of the self-adhesive property of press-polished vinyl film and of a new method of sealing or "embedding" relatively thin sheets of decorative material—decalcomanias, business cards, letter heads, maps, and the like—between two sheets of flexible vinyl film. The finished laminate is produced under heat and pressure to form a single sheet with the decoration sealed in and protected against damage by abrasion, solvents, stains, etc.

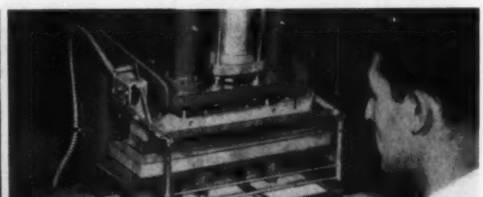
First commercial application of the new patented[1] process by Transeal, Ltd., Plainfield, N.J., is a self-sealing tobacco pouch. Other applications include eyeglass cases, place mats, maps that can be rolled up into a small compass, window display signs, and other flexible laminates

[1]U.S. Patent No. 2,536,773, W. M. Saidel, "Self-Sealing Container of Laminated Plastic Sheet Material." Products of Transeal, Ltd., are marketed by Universal Aviation Corp., New York, N. Y.

In production of tobacco pouches from laminated flexible film, piles of laminates are placed in clicker press and blanked to predetermined shape and size



Three tobacco pouches are heat-sealed in a single operation in the three pockets of this electronic sealing device



Laminated film spectacle cases protect the glasses, are compact and light in weight

Maps embedded in flexible film are protected against damage, take up small space when rolled

in which colorful presentation of decorative matter is desired.

Fabricating Pouches

In the production of tobacco pouches, a sheet of Bakelite's flexible Vinylite material, large enough to make three pouches, is laid out flat. The design to be embedded in the laminate is then placed in position on the upper surface. In the case of decals, they are applied in the usual manner by soaking them in water and then transferring the design to the vinyl film. This design is then dried or aged to develop sufficient strength to resist the pressure of lamination. After this drying period, a second sheet of vinyl film is laid in position and the resulting sandwich is placed between two highly polished metal sheets. This process is continued until a number of sandwiches have been built up, whereupon the resulting pile is placed in a press.

Lamination takes place under high pressure and at temperatures ranging from 300 to 400° F., depending upon the press load and the gages of film being used. The assembly is permitted to cool under pressure before removal from the press. During the laminating process the vinyl resin films unite to form a single transparent sheet with the decorative material permanently sealed inside. Color can be introduced into laminates of the type just described by using a colored bottom sheet or by placing a thin sheet of colored material over a clear backing sheet, laying the decoration in place, and covering all with another transparent sheet.

From the laminating press the sheets go to a clicker press where they are blanked to size. Final step in the production is to fold over one end of each blank and heat-seal the edges to form a pouch with a flap.

As a result of the press polishing operation, the finished laminate exhibits self-adhesive qualities which are highly desirable in a tobacco pouch. When such a pouch is filled with tobacco and folded in the usual manner, the lips of the pouch itself can be sealed together by finger pressure; also, the flap seals to itself as it is rolled. However, the pouch can be opened readily by simply stripping the film away from itself, and can be resealed an indefinite number of times.

It is claimed by Transeal, Ltd., that the degree of self-adhesiveness of the flexible laminate can be varied by using press-polishing plates with differing surface finishes and by controlling the pressure, temperature, and press time cycle during lamination. In addition, the self-adhesive characteristics can be reduced by applying to the surface a light film of talc suspended in oil.

The high frequency heat sealing machine used to form the side and bottom seals of the tobacco pouch has been specially adapted to the job. The sealing bars are serrated so that they form a strong decorative seam, and are shaped to produce all three seals simultaneously. Furthermore, a setup has been developed whereby three strips of folded laminate are placed in three pockets in the heat sealer and are seamed simultaneously in a single operation.

Spectacle cases are produced in a similar manner to the tobacco pouches, and offer advantages of light weight, low bulk, and protection for the glasses.

Signs and Displays

Probably the greatest potential field for these flexible laminated vinyl films is seen in point-of-purchase signs and displays. Here again the self-adhesive qualities of the press-polished material give almost startling results. For example, a window display sign carrying any desired sales message can be adhered to a glass window simply by washing the glass with water, applying the laminated display to the wet surface, and squeegeeing it in position. The laminated sign will remain in place indefinitely yet can be removed instantly simply by peeling it off.

The limitations on the material which can be embedded in the laminate are essentially only those of thickness. The decal or other decorative material can be tissue thin or any thickness up to about half that of the finished laminate.

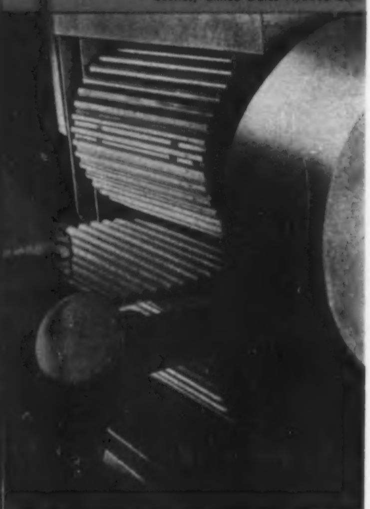
Advertising specialties, such as tobacco pouch at left below, are made by sealing letter heads, photographs, advertising messages, etc., inside vinyl film laminate

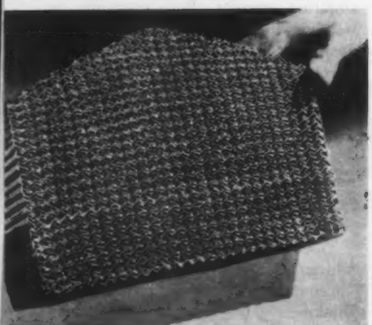
Courtesy Western Products, Inc.

Glass honeycomb core is made by corrugation method in continuous machine

First step in corrugation method is to form the sheets into half-hexagons

Courtesy United States Plywood Co.





Courtesy Honeycomb Co. of America

Densified honeycomb is made by compressing ⅜-in. aluminum honeycomb

HONEYCOMB

THE anonymous bee who first built a honeycomb was a pretty shrewd creature, because a honeycomb construction represents the most economical use of space and materials. But only recently has man learned to profit by the bee's example. Only recently has he discovered that a honeycomb section with a thin skin or face sheet to cover the open ends makes a sandwich material which is extremely strong for its weight and extremely economical of materials.

The technique of manufacturing such honeycomb core sandwiches was in its infancy when World War II ended. A number of radomes and other aircraft parts had been produced successfully—but the parts were expensive, they were not as uniform as they might have been, and the production methods used made more use of human hands than of machines.[1]

But honeycomb has come of age since 1945 and is being used successfully in a few pioneer commercial applications as well as in military aircraft. Large scale use of honeycomb sandwiches in military applications will probably delay the commercial development of the material by swallowing up the available honeycomb. But in the long run the defense program will undoubtedly encourage the commercial use of honeycomb by solving some of the production and application problems, thereby bringing down the costs of honeycomb sandwiches.

Resins Used

Honeycomb core can be made of a wide variety of material, but the most frequently used are paper, cotton, glass cloth, and aluminum foil. A plastic impregnant is used with the first three of these to make the material rigid enough for use as a sandwich core. A 20% phenolic impregnation is usually used with paper, and an impregnation of up to 50% phenolic resin with cotton. Polyester, phenolic, or nylon-phenolic (Conolon) resins are used with glass cloth.

Various types of phenolics are used in paper honeycomb. A water-soluble resin (like Bakelite's BR-15100) has a high degree of effectiveness, but makes the impregnated paper somewhat too brittle for some applications. An alcohol-soluble resin (like BV-9700) does not penetrate the paper as completely as does the water-soluble type, but the treated paper is far more flexible.

Plastics are also used in honeycomb sandwiches to provide the bond between the honeycomb core and the face sheets, which are made of any of a number of sheet materials such as: aluminum, plywood, plastic decorative laminates, Masonite, asbestos board, etc.

The nature of the skin or face sheet determines the adhesive used to bond the skin to the core. For metal skins, phenol-butyral, epoxy, or modified phenolic adhesives are generally used. Urea, phenolic, resorcinol, or any reliable wood glue can be used with plywood skins. For the alkaline board materials, such as Flexboard, phenolic and resorcinol adhesives are recommended, and casein glues have also been used. Urea, epoxy, resorcinol, or cold set phenolic adhesives are suitable for use with plastic laminate skins.

Present Applications

A marked trend towards aluminum core has been apparent recently in military applications where the increased cost is only a minor consideration, but it is doubtful whether aluminum foil honeycomb will ever capture as great a portion of the civilian market. Aluminum honeycomb is used in military aircraft for such parts as wing panels, flooring, fuel cell liners, spoilers, control surfaces, and

[1] See, for example, "Production of Honeycomb Cores," by J. D. Lincoln, MODERN PLASTICS 23, 127 (May 1946).

COMES OF AGE

bomb bay doors. Paper honeycomb is used for semi-structural panels, curtain wall panels, and for some radar transmission panels. It has recently found an important commercial application as a core material for plywood flush doors and has been used for shipping containers; a few prefabricated houses have also been made of paper honeycomb panels.

An outstanding application of paper honeycomb is the Chrysler Corp. factory in Indianapolis, scheduled for completion this summer. The walls of this factory are made up of 60,000 sq. ft. of aluminum-faced paper honeycomb sandwich panels 2 in. thick, 4 ft. wide, and 12 ft. long. The panels are made by the Cycleweld Div. of Chrysler Corp.

Cotton honeycomb is used in structural panels and floor panels where the requirements as to crushing and shear strength are critical or where insulation is required. Glass cloth honeycomb is used in radomes, where electronic considerations make other materials unsuitable for this application.

Methods of Production

There are two basic methods of manufacturing honeycomb cores: the corrugation method and the expansion method. In the former method, the sheet material is first

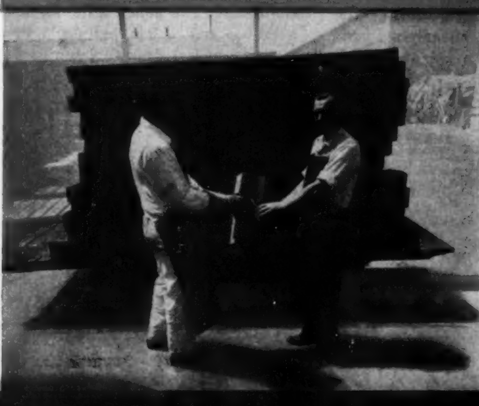
All photos this page courtesy Douglas Aircraft Co., Inc.

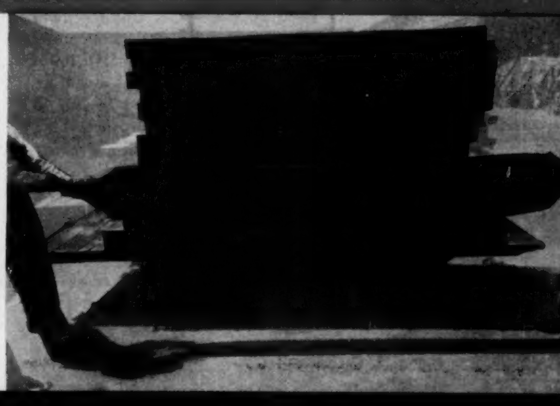
In expansion method, roll of paper (lower left) is fed into machine, glue lines are printed on both sides of it (upper right), and the roll is run through an oven to cure the glue lines

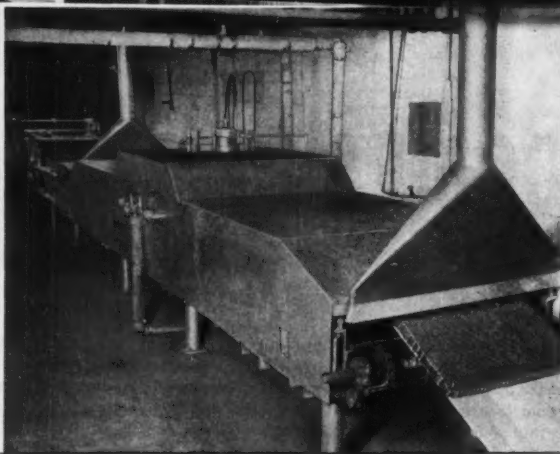
After the paper emerges from the oven, it is fa
folded into a pack which is then cut into blo

Blocks of folded paper are subjected to heat and pressure to set the glue lines. They are then ready to be expanded (below)

Blocks with glue lines set are expanded by hand, placed in racks in the expanded position, dipped in impregnating resin, and given a final cure







Photos courtesy Lincoln Industries, Inc.

Paper honeycomb core material is pulled through bath of phenolic impregnant on a conveyor and is expanded as it is pulled

After being impregnated, core material is held in expanded position as it passes through curing oven. It emerges from machine (right) ready to cut

corrugated into half-hexagons. The corrugated sheets are then stacked and bonded.

In the expansion method, glue lines are put on flat sheets which are then stacked, bonded to each other, and expanded after bonding to form the honeycomb pattern.

As a rule, the corrugation method is used to make aluminum, cotton, or glass cloth honeycomb; and the expansion method is used to make paper honeycomb. This is true of the following producers: United States Plywood Corp., New York, N.Y., (aluminum, paper, cotton); Cycleweld Div., Chrysler Corp., Detroit, Mich., (paper); Western Products, Inc., Newark, Ohio, (glass cloth); Douglas Aircraft Co., Inc., Santa Monica, Calif., (paper); Lincoln Industries, Inc., Marion, Va., (paper); and Honeycomb Co. of America, Inc., Bridgeport, Conn., (aluminum, paper, cotton).

Courtesy Zenith Plastics Co.

Polyester-impregnated glass cloth core and skins are used in large radome

The one exception to the rule is California Reinforced Plastics Co., Berkeley, Calif., which is using the expansion method to produce both aluminum and glass honeycomb core materials.

Corrugation Method

A typical example of the corrugation method of making honeycomb is that used by Western Products, Inc., to make glass cloth honeycomb. The sheets of glass cloth are first impregnated with phenolic or polyester resin (depending upon the end use), and molded to the half-hexagon corrugation in male and female molds. (Some manufacturers form the half-hexagon between matched gear wheels). After the corrugated sheets have been cured, they are trimmed to size and additional resin is added to the flat portions in a glue spreader.

The sheets are then stacked in an automatic machine which indexes each sheet so that the flat portions of adjacent sheets are matched. After the stack has reached the required thickness, it is removed from the indexing machine, placed in a jig, and cured in an oven.

When thicker blocks are desired, the cured blocks can be dipped in additional resin, stacked, and recured. With this method, Western Products is now producing honeycomb blocks 8 by 2 by 2 feet.

One unusual step in the manufacture of honeycomb is used by Honeycomb Co. of America to produce an experimental material which it calls "densified honeycomb." This is made by taking $\frac{3}{8}$-in. cell size aluminum honeycomb and compressing it until the honeycomb cells collapse and lose their characteristic shape. The company claims that this increases the compression strength of the core at a ratio faster than the increase in weight. A block of this densified core material is shown in the photograph on page 84.

Expansion Method

An example of the expansion method is that used by Lincoln Industries to produce paper honeycomb core. The paper is mounted on a roller and is carried on a controlled tension unit through a glue spreader which prints lines on both sides of the paper. The lines are staggered so that those on top are spaced midway between the lines on bottom. The cell size of the finished honeycomb is controlled by the distance between the glue lines.

The paper then travels to the stacking station of the machine. There the paper is folded and

stacked by means of vacuum cups over the top surface and a series of air jets under the bottom of the paper. The folds are made by a ram-operated bar which has notches in it so that it does not contact the wet glue lines as it presses against the paper.

In operation, the vacuum cups and air jets are turned on simultaneously, causing the paper to rise. As the paper hits the vacuum cups, the stacking bar moves forward, folding the paper and causing the glue lines to adhere, thereby forming one section of the honeycomb.

The stack is then pushed forward by the action of the bar and forced between two cutting knives, one cutting from the top edge and one from the bottom of the stack. The knives are set so that they remove about 1/32 in. from the top and bottom of the honeycomb. As this action continues, the machine builds up a stack which is much like a folded paper fan with the folds glued together. The height of the stack is the eventual thickness of the honeycomb core. Because of the folds, the honeycomb is closed on top and bottom.

There is about 12 in. of tightly stacked honeycomb between the stacking bar and the trimming knives. A series of electrical heating elements above and below the stack in this area produces sufficient heat to cure the resin glue lines.

After the top and bottom surfaces have been trimmed, the material is pushed into a bath of phenolic resin and pulled through the bath on a conveyor. As it is pulled through, the continuous length of honeycomb is expanded and then held in the expanded position on the conveyor as it passes through a curing oven. This cures the phenolic impregnant and the only remaining operation necessary is to cut the continuous honeycomb into the desired length.

The method used to produce paper honeycomb core at Douglas Aircraft Co. is similar to that described above up to the point where the glue lines are set. At this point, in the Douglas method, the unexpanded honeycomb is removed from the machine in blocks, stretched to the desired expansion ratio by hand, dipped into an impregnating resin, and then placed in a rack and cured.

Future Possibilities

There are innumerable uses for a low density structural material like honeycomb sandwich, and the downward trend in the cost of the material is a good indication that it will move into many of the possible applications. One manufacturer of honeycomb cores flatly predicts that honeycomb sandwiches will be used "for at least 40% of all new airframe weight by 1956."

Honeycomb sandwiches are being used for many knock-down transportable military structures, and there is a strong possibility that honeycomb will move into military housing and thence into prefabricated homes like those produced on a small scale by Acorn Houses, Inc., Cambridge, Mass.

United States Plywood has announced that it is producing standard Armorply Honeycomb Panels for use in curtain wall construction. These panels have a 3/4-in. cell paper core and have faces of aluminum, magnesium, stainless steel, or porcelain enamel steel. The panels can be made in sizes up to 5 by 10 ft. and from 1 to 4 in. thick.

Armorply Honeycomb with Perlite insulation material added has been used for the walls in the Engineering Office Building of the new General Motors Research Center in Detroit. Paper honeycomb with aluminum skins is being used for sliding doors in the new Aluminum Co. of America building in Pittsburgh. A few other applications are in the design stage. For example, aluminum foil honeycomb with the voids filled with a foamed-in-place resin may be used for seaplane floats.

Another possible market for honeycomb is indicated by the fact that a 1½ in. thick sandwich with paper honeycomb core and Masonite faces can be made, according to Honeycomb Co. of America, to *retail* for between 70 and 80¢ per square foot. This would put the material in direct competition with 5/8 in. fir plywood and other low cost building materials.

Consider the possible variations, such as different thicknesses, the introduction of insulation material in the honeycomb cells, and the use of other low-cost skins—and the future of honeycomb becomes bright. Yes, honeycomb has come of age and is going places.

Right—Knockdown shelter for Corps of Engineers is made of aluminum-skinned honeycomb panels

Reflector for GCA landing system equipment has an aluminum face and a curved honeycomb core

Photos courtesy United States Plywood Corp.

S.P.I. Annual Meeting

AT THE Annual Meeting of the Society of the Plastics Industry, Inc. held May 24th and 25th at the Greenbriar, White Sulphur Springs, W. Virginia, Gordon Brown, vice president Bakelite Co., Div. of Union Carbide and Carbon Corp., was elected director and president for the fiscal year June 1951 to June 1952. Retiring president Horace Gooch, Jr., president of Worcester Moulded Plastics Co., now becomes director and chairman of the board of S.P.I. Director and vice president is Dale Amos, president of Amos Molded Plastics. J. E. Gould, vice president of Detroit Macoid Corp., becomes director and secretary-treasurer.

Section directors elected were Howard Yates, Crystal Glass & Plastics, Ltd., Canadian Section; Ben W. Rau, G. Felsenthal & Sons, Inc., Midwest Section; George V. Sammet, Jr., Northern Industrial Chemical Co., New England Section; D. C. Severance, Lee Deane Products, Inc., Pacific Coast Section.

The following Industry Division Directors were elected: Button—Thayer Baldwin, Patent Button Co.; Engineering & Technical—N. J. Rakas, National Automotive Fibres, Inc.; Film & Sheeting—Raymond S. Newell, Respro, Inc.; Machinery—John S. Cotner, The Hydraulic Press Mfg. Co.; Reinforced Plastics—Leonard S. Meyer, Plastics Div., Western Products, Inc.

Directors at Large for the coming fiscal year are: Roy Cunningham, Westinghouse Electric Corp.; Henry E. Griffith, Plax Corp.; J. R. Hoover, B. F. Goodrich Chemical Co.; Joseph A. Jackovics, Columbia Protektosite Co., Inc.; W. W. Knight, Jr., Plaskon Div. Libbey-Owens-Ford Glass Co.; J. F. Nicholl, Lumite Div., Chicopee Mfg. Corp. of Georgia; Frank E. Selz, General American Transportation Corp.

Program

The program at the Greenbriar, arranged by a committee headed by J. R. Price, division manager, Bakelite Co., was well paced and definitely in tune with the times. N. A. Backscheider, president of Recto Molded Products, Inc., was chairman of the May 24th session.

Chairman at the Annual Banquet was Horace Gooch, Jr., outgoing president of S.P.I. The 10th Annual Hyatt Award (see p. 78) was presented by The Honorable Okey L. Patteson, governor of West Virginia. The incoming president, Gordon Brown, was inducted. Feature speaker was Arthur H. "Red" Motley, head of Parade Publications, Inc.

Edward Singer, president of Victory Mfg. Co., presided at the May 25th session.

Abstracts of the papers presented at the meeting sessions follow:

"The Thermoplastic Material Supply Situation," *by Mahlon G. Milliken, vice-president, Hercules Powder Co.*

Production of thermoplastics has grown from 10 million lb. in 1930 to about 685 million lb. in 1950. The end of the climb has not yet been reached, but it is possible that the rate of climb will slow down.

The supply of linters and wood pulp will soon be increased so that the supply of cellulose materials in the last quarter of this year will be adequate for all needs short of war. Vinyl makers are not as optimistic.

There will be an overall increase of 10 to 20% this year in manufacturing facilities for thermoplastics.

"The Thermosetting Material Supply Situation," *by F. A. Abbiati, general manager, Plastics Div., Monsanto Chemical Co.*

Seventy percent of all phenol produced is now going into plastics; 60% of all urea; 75% of all formaldehyde. At that level it is impossible to expand the plastics at the expense of other consuming industries—more basic materials will have to be produced, and this is in prospect.

This year we will produce 335 million lb. of phenol, which is about 40 million lb. short of demand; but that 40 million lb. gap will be closed by the end of the year and an expansion of 162 million lb. of phenol is projected by the end of 1952, so we will be producing at a rate of 500 million lb. per annum by the end of next year. Conversion facilities for turning phenol into molding powder are now sufficient to handle 30 million lb. a month.

In urea, there is no shortage of

(*Continued on p. 164*)

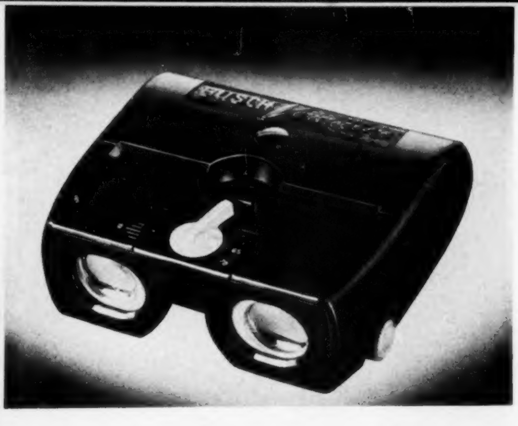
NEW S. P. I. OFFICERS

Horace Gooch, Jr.
chairman of board and director

Gordon Brown
president and director

Dale Amos
vice president and director

J. E. Gould
secretary-treasurer and director



Above: Molded plastic parts in stereoscopic viewer assure light weight, integral color, ease of assembly. Left: Lever atop viewer adjusts distance between eye pieces; light switch plate on bottom is operated by the thumb

Styrene Parts in Stereo Viewer

IN order to match the fine quality of its new Busch Verascope f/40 camera, which selectively takes either stereo or single-frame 35-mm. photographs, Busch Camera Corp., Chicago, Ill., has developed a molded plastic stereoscopic slide viewer of advanced design and construction. The viewer, which has a number of parts injection molded of styrene, as well as a vinyl light reflector and diffuser, accomodates the Verascope slides, providing a lifelike third-dimensional effect and taking advantage of the Verascope camera's 30% larger picture area and horizontal format. The viewer is internally illuminated with a small bulb powered by two "D" size batteries.

Important in the selection of molded plastic for the new viewer was the fact that styrene parts assure light weight, integral color, and ease of assembly. Also appreciated was the freedom of design offered by the plastic, making it possible to develop a compact, smoothly contoured viewer which fits comfortably in the hands and has a pleasing "touch."

Had metal construction been adopted, design possibilities would have been considerably more limited. In addition, finishing and assembly of the instrument would have involved various machining operations, painting, etc., increasing costs and slowing down production.

Engineering design and construction details of the Verascope viewer were worked out in cooperation with H. S. Ruekberg, vice president in charge of engineering of Elmer E. Mills Corp., Chicago, Ill. The plastic parts are molded by Mills, and all assembly operations, including installation of the high-grade optical lens system, are performed by Busch. Credit for the design styling of the unit goes to Michael Saphier Associates, New York, N.Y.

Molding Details

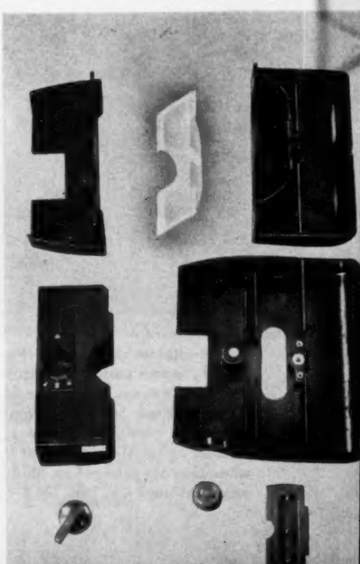
Body parts of the viewer are molded in jet black styrene, with red styrene used for the light switch and adjustment knobs. All the molded parts are produced on 8-oz. presses.

The four black parts, made in a family mold, include the bottom; the two sections forming the top of the viewer; and the eye piece housing, which has a nose recess permitting the viewer to be held directly up to the eyes. The bottom section has four molded-in inserts, including a tripod socket and three fittings for electrical components.

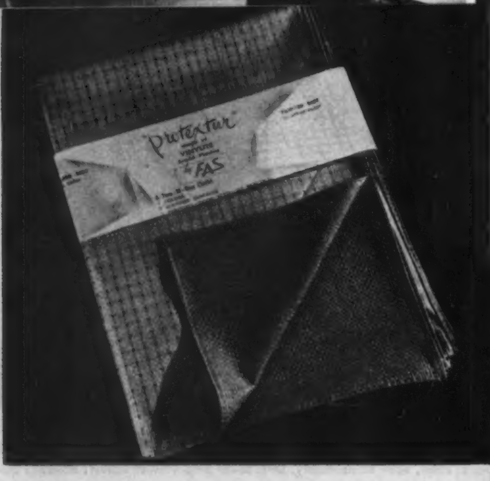
All the red parts are produced in a multi-cavity family mold. These molded parts include three each of the inter-ocular lever (which adjusts the lenses to the exact distance between the eyes), the focusing knob, and the flat light-switch control plate, which mounts on the underside of the stereo viewer.

The light reflector and diffuser consists of a white Vinylite mat-surfaced sheet, hot formed to shape, which slips into the light bulb recess within the housing and remains in position when the viewer is assembled. Use of this formed vinyl sheet eliminates the need for spray painting the curved recess and gives a reflecting and diffusing surface which remains effective indefinitely.

Body parts, knobs, and switch plate are styrene; the white reflector is vinyl



PLASTICS PRODUCTS



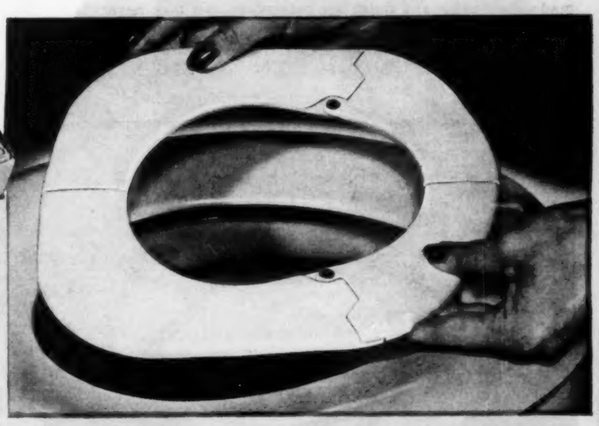
Above—**Tablecloth made of 8-gage embossed Vinylite film is reversible. One side has a solid color, the other has a two-color check pattern. Both sides are embossed to resemble a woven fabric in appearance and feel. The cloth has a narrow stitched hem. Made in 54 by 54-in. and 54 by 72-in. sizes by Frank & Sadev, 330 Fifth Ave., New York, N. Y.**

Below—**Cartridge loading device has transparent reservoir made of extruded acrylic tubing. This permits the operator to check the powder level at all times, and makes the device lighter and less expensive than earlier models. The 2-in. diameter tubing is made by Plax Corp., Hartford, Conn., for Lyman Gun Sight Corp., Middlefield, Conn.**

Above—**Raincoat made of 4-gage Velon film has snap fasteners molded of Tenite I cellulose acetate. The plastic snaps are rust-proof, quieter than metal snaps, and can be made to match the vinyl coat in color. The plastic snaps are attached in the same manner as metal snaps except that some heat is used when they are crimped on. Made by National Plastikwear Fashions Co., Inc., 700 B'way, New York, N. Y.**

Below—**Colorful scale models of Pan American Strato Clippers are molded of Tenite I cellulose acetate. The 9-in. long models are molded with the underside of the fuselage left open, and information about the Clippers appears on the interior surface. Stickers on wings and tail provide identification. Made by Thomas Mfg. Corp., 80 Clinton St., Newark, N. J., by agreement with Pan American and Boeing.**

Child's toilet seat molded of cellulose acetate is hinged so that it folds to 4½ by 8 inches. It is thus easy to carry in mother's purse, daddy's coat pocket, or the glove compartment of the car. The seat weighs only 8 oz. and comes with polyethylene carrying case and deflector. Made by Barridge Co., 1060 Howard St., San Francisco, Calif.



Left—Styrene holder for toilet paper, wax paper, or paper towels is molded in one piece, contains no parts to remove when changing rolls. The rolls simply slip over an upright peg molded as part of the holder. Because the rolls are held in a vertical position, they do not spin and waste the paper when children pull them. Made in five colors by QWKE Distributors, 8035 Dibble Ave. N.W., Seattle 7, Wash.

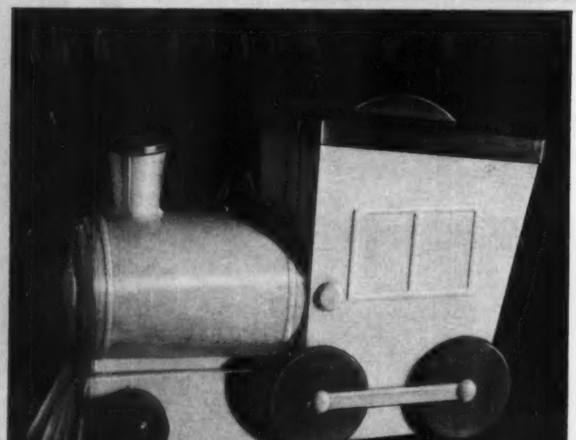
Right—Colorful back-lighted pictures are made of translucent Vinylite rigid sheet and framed in wood or metal in a variety of colors and finishes. The frames enclose fluorescent lights which illuminate the colorful pictures from within. Made by Helms Products, Inc., 100 Lexington, S.W., Grand Rapids 4, Mich., in three sizes: 23 by 26 in., 27 by 34 in., and 30 by 37 inches

Left—Pull toy molded of cellulose acetate is strong enough to support the weight of an adult. The dog moves its legs, wags its head up and down, and "growls" when pulled. The toy is 18½ in. long and has flexible ears and tail. Made by Nosco Plastics, 17th & Cascade Sts., Erie, Pa.

Below—Table mats with the fine appearance of delicate fabric are braided of Velon monofilaments. They are thus stain-proof, non-absorbent, and can be kept clean easily by wiping with a damp cloth or rinsing under the kitchen faucet. Because of the nature of the saran material of which they are made, their color and finish are permanent and they never need ironing or starching. The mats are made in seven bright colors in a 13- by 19-in. oval and an 18-in. round size by Jos. Brandt & Bro., Inc., 521 E. 72nd St., New York, N. Y.

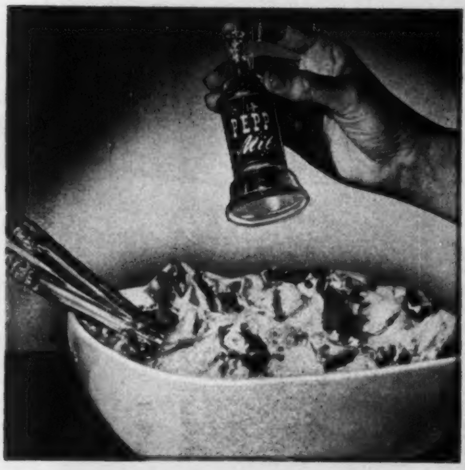
Above—Pipe cleaners can be kept handy and ready for use in special pockets built into the flap of a tobacco pouch made of Vinylite film. All seams in the pouch are electronically sealed, and gussets in the sides allow the pouch to open wide for easy access to the tobacco. The pouch is produced by Korey Products, 250 West Broadway, New York, N. Y.

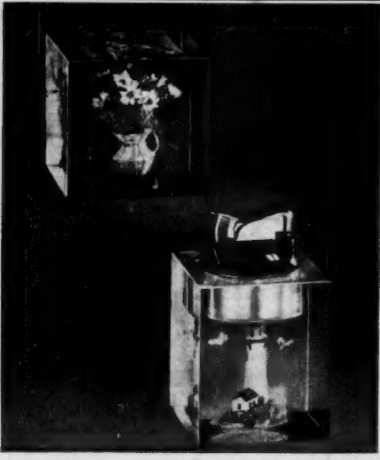
Below—Cookie jar molded of styrene resembles a toy locomotive. It is 11 in. long and 7 in. high and has a 4 by 4-in. opening atop the "cab." The lid lifts off for easy access to the contents. In addition to serving as a cookie jar, the train can be used as a plant holder, as a decoration for the nursery, or as a toy. Molded in red, blue, yellow, or white by California Moulders Inc., 814 E. 29th St., Los Angeles 11., Calif.



Above—Novelty electric clock called the Kit Cat Klock looks like a cat. The tail moves like a pendulum, and the eyes move back and forth in unison with the tail. Case, eyes, and hands are molded of Beetle urea, and are thus chip-proof and easy to keep clean. The mouth, hands, numerals, and paws are luminous. Manufactured by Allied Mfg. Co., 2200 25th St. S., Seattle, Wash.

Below—Pepper mill molded of styrene holds whole peppercorns and grinds them as they are needed. It can be operated with only one hand because it has a push-button on top instead of a crank. It is molded of transparent material, and the level of contents is therefore always visible. The mill can also be used as a salt cellar and is good for picnics because it is spill-proof. Made by Kitchen Plastics, 1401 W. 8th St., Los Angeles 17, Calif.





Above—Block of acrylic with a lighthouse and sea gulls cast into it serves as a base for a cigarette lighter. The acrylic block is 2⅛ by 2⅛ by 2⅝ in. and has a depression in the top into which the lighter mechanism fits. Another cast acrylic block, with a miniature basket of flowers cast in it, serves as a decorative paper weight. Made by the Clear-Float process by Plastic Developments, Inc., Kilby St., Attleboro, Mass.

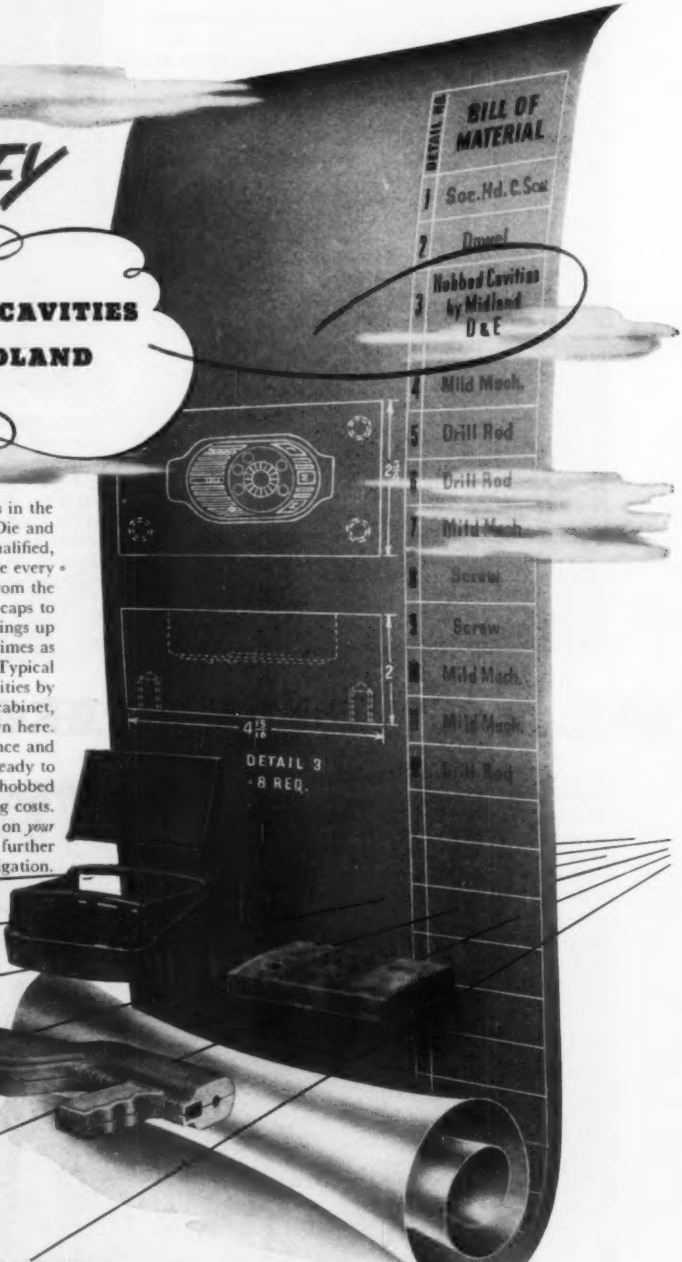
PLASTICS PRODUCTS

Below—Fly box molded of Tenite II cellulose acetate butyrate has top, bottom, and two sides hinged so that they open out flat when the box is unfastened. Cork strips cemented to the interior surfaces afford anchorage for the hooks. The box known as the One-O-One Fly Box, is 6 by 1 by 3⅛ in., and is held closed by a molded-in lug. It is molded by Grant & Roth Plastics, Inc., 1400 N.W. 14th Ave., Portland, Ore., for T. A. Bessonnett, Creswell, Ore.

Above—Unusual stuffed toy made of 8-gage vinyl film is filled with shredded Styrofoam which has a luminescent substance mixed with it so that the toy glows in the dark. The toy, called Trans-Glo Kitty, is soft to the touch and washable. The seams are heat sealed. Made by The Tarrson Co., 540 Lake Shore Drive, Chicago 11, Ill.

SPECIFY

HOBBED CAVITIES by MIDLAND



Home of the largest hobbing press in the plastics industry, Midland Die and Engraving is the ONE source qualified, equipped and manned to handle every Hobbed Cavity requirement—from the smallest tooth paste tube caps to radio cabinets, escutcheons and housings up to 80 square inches—nearly three times as large as ordinary hobbing limits. Typical examples of large hobbed cavities by Midland are the portable radio cabinet, radio cover and toy gunstock shown here. Midland engineering, experience and facilities are ready to serve you—ready to deliver *on time* uniform, accurate hobbed cavities at a fraction of machining costs. Specify Hobbed Cavities by Midland on *your* Bill of Materials. Or write for further information and estimates. No obligation.

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Extrusion Compounding

SOME injection molders do their own compounding and coloring of thermoplastic materials by premixing the required ingredients and then passing them through an extruder where the mixture is subjected to the thorough milling under heat and pressure which is so necessary in order to obtain a completely uniform compound. Working along the same line, some extruders are producing finished sections directly from the dies of compounding extruders which are fed with material components that have already been physically premixed in equipment such as ribbon blenders. Then, too, there is a trend among molders and certain material companies who offer a specialized coloring service, to make use of extruders for coloring styrene when they are faced with difficult coloring problems such as those encountered in producing pearlescents or transparent colors in styrene.

One example of the successful use of extruders in compounding by a materials maker is the installation at the Parlin, N.J., plant of Hercules Powder Co. Here a twin screw compounding-extruder, manufactured by Welding Engineers, Inc., Machinery Div., Norristown, Pa., is in operation. Working seven days a week, around the clock, down-time to date for maintenance has been negligible. Running on this schedule, this one machine alone turns out some 80 tons per month of thoroughly compounded Hercocel A cellulose acetate and Hercocel E ethyl cellulose molding material. Most of the compound thus produced is superior extrusion grade, the specifications for which require an absolutely complete milling job. Apparently this compounding-extruder lives up to the claims of the manufacturer that the milling action in the machine is comparable to that obtained in standard roll mills.

* Reg. U.S. Pat. Office

The set-up at the Parlin plant has been so engineered that one man can perform all of the operations necessary to produce and pack pelletized thermoplastic molding compound, starting with the basic flake, plasticizer, and colorants. In addition to operating the compounding-extruder, this man can run a ribbon mixer, a special hopper loading device, a pelletizer, and a scalping screen which separates fines and overs from the exactly sized pellets and delivers each to its respective drums. The same operator also check weighs each drum of pellets when it is full and closes it ready for shipment. In actual practice, however, two men are generally used to insure maximum production.

Start of Compounding

The first step in this extruder-compounding operation consists of loading the material components in the ribbon mixer. These components include flake, plasticizer, and colorant. Plasticizer is used in amounts varying from 20 to 50 parts per 100 parts of flake, according to the flow required in the finished material, the softer flows needing more plasticizer. The colorants are preweighed and preblended in another portion of the plant so that one labeled package will produce the exact color required. Installed in this department is the latest type of equipment for accurate weighing of the colorant components.

After a short mixing time, the blended material is emptied from the ribbon mixer into a standard material drum which is conveyed to the loading end of a Cesco dumper, manufactured by the Colson Equipment Co., Los Angeles, Calif. This dumper, illustrated in

All photos courtesy Welding Engineers, Inc.

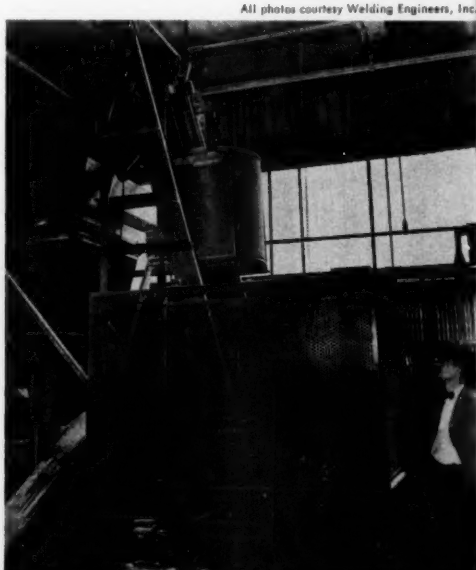


Fig. 1—A drum of mixed plastic material to be extrusion-compounded is carried up incline of dumper. Contents are automatically dumped into a large storage hopper, then are gravity fed to hopper of compounding-extruder

Fig. 2—Overall view of compounding-extruder installation showing neatness and compactness of main unit, dumper, storage hopper. Set-up needs relatively small floor space

Fig. 3—Rods ⅛ in. in diameter are extruded from 20-orifice die. They emerge in circular pattern, are guided into cooling bath in flat, parallel pattern by metal bar with 20 slots

Fig. 1, carries a full drum of mixture up along an inclined pair of rails and automatically dumps the contents of the drum into a large storage hopper. The material is fed by gravity from this storage hopper to the standard compounding-extruder hopper. The rate of flow is controlled by adjusting the orifice in the storage hopper.

The neat and compact installation of the dumper, storage hopper, and compounding-extruder is shown in Fig. 2, which further illustrates the comparatively small amount of floor space required for installing such a set-up.

Extruded as Rods

The compounding-extruder, as shown, is equipped with a 20-orifice rod die and hence produces 20 rods, each ⅛ in. in diameter. Figure 3 illustrates the method by which the extruded rods, as they emerge from the die in a circular pattern, are guided to form a flat parallel pattern. From the die, the rods enter a water bath. The metal bar which guides the extruded rods into the water cooling bath has 20 slots machined on its underside. Once each of the extruded rods has been placed in its respective slot, they will all travel uniformly and parallel to each other.

The rods, as they emerge from the water, pass over a perforated metal cooling and drying trough, at the end of which is a second guide bar. The rods pass under this second bar and then upward to the feeding mechanism of a special high-speed pelletizer. The feed mechanism of this pelletizer not only forces the rods against the cutting blades of the unit, but also acts to pull the rods through the water bath and along the flat bed of the drying trough. This pulling action of the pelletizer is sufficient to eliminate the necessity for a conveyor belt which is normally a standard piece of auxiliary equipment used with extruders.

Residual Heat Used

No heat is applied to any section of the drying trough. The residual heat in the extruded rods themselves is sufficient to dry them thoroughly before they reach the end of the trough. As a matter of fact, by the time the rods enter the pelletizer, their temperature is still in the

neighborhood of 180° F.—sufficiently high to evaporate all water picked up in the cooling bath.

The operation from the water cooling bath along the drying trough and up to the pelletizer feed is illustrated in Fig. 4. After the pelletizer cuts the rods it delivers the material to what is known as a scalping screen, manufactured by W. R. Witte Co., Linden, N.J. This is a vibrating mechanism (Fig. 5) equipped with different size screens which separate the material into the three sizes—accurately sized pellets, fines, and overs—and delivers them to three different compartments, each of which feeds to a separate chute.

The center drum in Fig. 5 is completely filled with accurately sized pellets, whereas the drums on either side of it hold the very small quantity of undesirable sizes which are produced by the pelletizer. These undesirables are not scrap, since they are reworked back into the material in much the same manner as an injection molder will rework sprues and runners.

Moisture Control

One of the major difficulties which was encountered when Hercules first decided to compound by extrusion was that of moisture. A perfect pellet of compounded material must be completely homogeneous and free from defects such as trapped air or gas. How moisture is eliminated in this operation is best explained by a brief description of the Welding Engineer's compounding-extruder.

This machine is designed with what actually amounts to three operating sections. The first section, at the hopper end, performs a large percentage of the compounding action. An adjustable pressure plate fitting closely around the flights of the screws at the end of this first section creates sufficient back pressure to enable the screws to do their large share of the compounding job. At the second section, the barrel is open at the top and it is at this section of the compounding-extruder that the unwanted moisture, ranging up to 2%, is driven off. The moisture is picked up from the top of this section by an exhaust system which vents it outside the building.

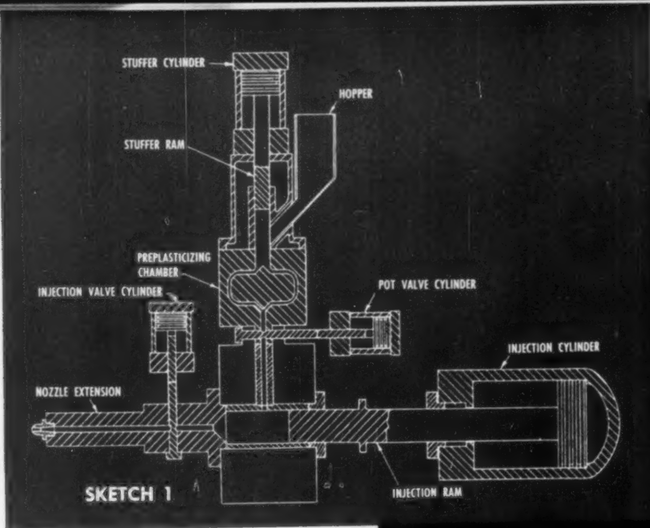
The third section of the compounding-extruder is closed and it is here that sufficient pressure is built up to force the now thoroughly softened and compounded material through the orifices of the die.

Another interesting feature of this two screw compounding-extruder operation is that changing over from one material to another or from one color to another does not require dismantling the extruder and cleaning out the barrel and the screws. Changing over is accomplished simply by following up with the next color or the next material required. Although change-overs, of course, are not performed any more frequently than is absolutely necessary, even the worst color change-overs produce no more than 70 lbs. of off-color material and are accomplished in approximately 15 minutes.

The extruder-compounding method just described has been so successful that Hercules is expanding its extrusion compounding set-up by the addition of a larger Welding Engineer's compounding-extruder.

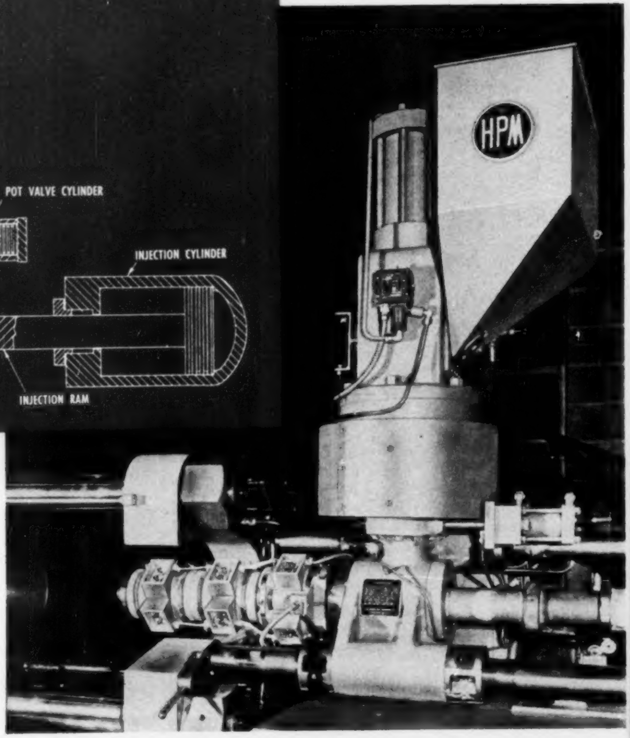
Fig. 4—From cooling water bath, the rods pass over perforated cooling and drying trough, under second guide bar at end of trough to pelletizer. Residual heat dries rods

Fig. 5—Feed mechanism of pelletizer (top), pulls rods along trough. Perfect pellets are separated from fines and overs by vibrating screens in scalping machine shown in center



All illustrations courtesy
The Hydraulic Press Mfg. Co.

Above: Schematic layout of major operating components of a 32-oz. minimum capacity preplasticizing unit which can be used to increase capacities of 9- and 16-oz. injection molding machines



Close-up view of preplasticizer diagrammed in Sketch 1 as installed on standard 16-oz. injection equipment

Preplasticization in the Machine

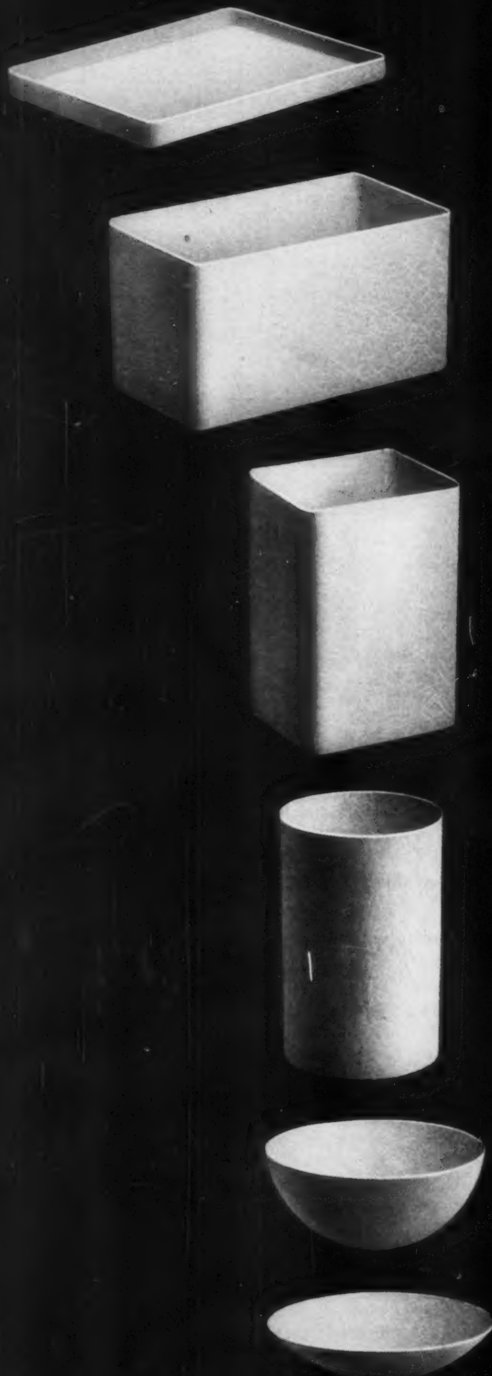
Capacity of injection machines is vastly increased by preplasticizing units, without resort to machines of prohibitive size

MANUFACTURERS of injection machines are constantly investing thousands of dollars in research and development work, aimed at obtaining faster cycles, larger capacity, bigger platen areas, increased clamping capacity . . . all-around improved operation. Of all the developments which have emerged from the laboratory and been placed in use as standard equipment, there is little doubt but that more money has been expended on preplasticization and preplasticizers than on any other improvement in injection molding machinery.

Several years ago the first injection machine equipped for preplasticization was placed on the market. Later, another type of preplasticizer was produced as an integral operating component of the machine. Still later a machine was engineered which used an extruder for preplasticization. All of these developments have been successful.

Now The Hydraulic Press Mfg. Co., Mt. Gilead, Ohio, after thoroughly working out the bugs during simulated production runs in its laboratories as well as during actual production runs in the field, has delivered two fully proved preplasticizer-equipped units—a 32- and a 200-ounce. The preplasticizer or stuffer on the smaller machine, which can be added as a conversion unit to most 16-oz. H.P.M. machines now in operation, follows the general principle of certain others now on the market, in that the softened plastic material is forced directly from the preplasticizer into the injection cylinder. With this type, several strokes of the preplasticizer piston are required to fully charge the injection chamber, and charging can only occur when the injection ram is retracted.

On the other hand, the preplasticizer on the 200-oz. unit, which is assembled on a 60-oz. machine, goes (*Continued on p. 102*)



tote box
tray
shipping container
trough
instrument case

tool chest
foot locker
refrigerator locker
laundry basket
machine housings
machine guards
truck body
trailer body

luggage
laundry hamper
medicine cabinet
file cabinet
telephone booth

waste basket
garbage pail
kitchen cannisters
ducts
rods

helmets
radomes
shelters
structural panels

boat hulls
sinks
baby carriages
light reflectors

one step further in efficiency. Here the design is such that the softened material is pumped into a holding or prefill cylinder chamber, which serves as an accumulator for the thoroughly preplasticized thermoplastic material. Thus, with one stroke of the piston in the prefill cylinder, a complete charge is delivered to the injection chamber. One of the big advantages of this design is that the stuffer can work practically all the time except for the very short period required for the single stroke of the prefill piston. In this case, the minimum cycle for fast running jobs is not a function of the length of time the injection piston is retracted.

Now under construction by H.P.M. are preplasticizers which can be installed on its 9-oz. machines and which will increase the capacity of these units from 9 oz. of styrene to a minimum of 20 oz. and in certain cases to as high as 34 oz. per shot. This conversion unit is similar to that used on the company's 32-oz. preplasticizer equipped machine, which itself is a converted 16 oz. and which will also, under certain circumstances, mold a heavier shot of styrene than the capacity at which it is presently rated.

Operator removes ice cream freezer lid from a 32-oz. machine during test run

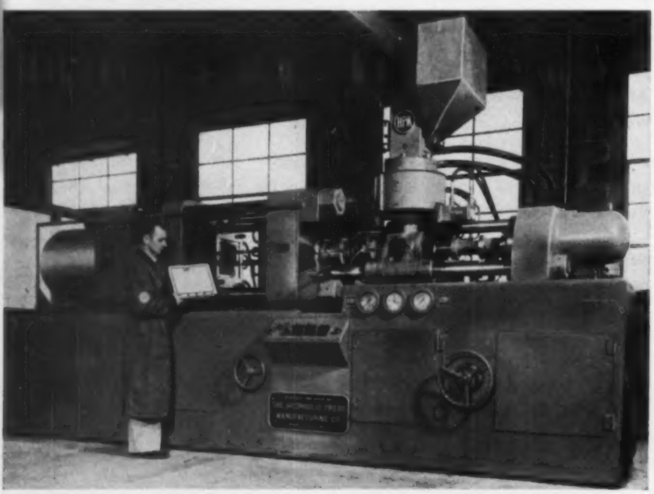
9- and 16-Oz. Unit

The principle of operation of the simpler type of preplasticizer, which has been designed to increase the basic capacities of 9- and 16-oz. machines to 20 and 32 oz. respectively, is shown in the schematic drawing, Sketch 1. Material is fed automatically from the hopper into the preplasticizing chamber by a reciprocating plunger actuated by a double acting hydraulic ram. This feed plunger action forces the molding material around a spreader in the preplasticizing chamber. The heating surface in this chamber is much greater than in the conventional heating cylinder and the heating action is greatly increased because heat is applied to both the spreader and the chamber housing. The spreader is held in position in the center of the chamber by supports which may be likened to the spokes of a wheel. Each of these spokes is drilled and each of them, as well as the spreader body itself, houses a series of cartridge-type electric heating elements. The injection chamber itself is encircled by electric band heaters.

The manufacturer states that the preplasticizing chamber is a one-piece unit. Accordingly, there is little if any possibility of material leaks and subsequent contamination. There is no torpedo or spreader in the injection chamber. Both the nozzle extension and the delivery end of the H.P.M. preplasticizer are equipped with hydraulic-electric slide valves.

In operation, the following sequence occurs, beginning at the time that injection has occurred, with pieces cooling in the mold and the injection plunger retracted: The feed ram or pump of the preplasticizer feeds material through the preplasticizing pot into the injection chamber. This pumping action continues until the injection chamber is completely filled, after which the feed ram automatically stops. What actually happens is that the thoroughly softened material pumped into the injection chamber forces the injection piston backward until it actuates a limit switch which stops the action of the preplasticizer piston. When the cycle controller calls for injection and the clamp pressure is built up on the mold, a pressure switch is actuated, which closes the slide valve on the preplasticizer pot and at the same time opens the nozzle shut-off slide valve. Injection then proceeds in the usual manner.

From the moment that the injection plunger starts forward, the preplasticizer feed plunger is inoperative. After a pre-determined "in" time of the injection plunger, it is retracted to a point back of the opening between the preplasticizer and the injection chamber. At this point, another electric switch, actuated by the retracted plunger, energizes the two hydraulic-electric slide valves, causing the one in the



On 16-oz. unit equipped with 32-oz. preplasticizer, part is molded at lower heater temperature and on faster cycle than for same mold on 22-oz. machine without preplasticizer

nozzle to close and the one in the pot to open. Immediately, the feed plunger of the preplasticizer starts pumping and continues to pump softened material into the injection chamber until the chamber is full.

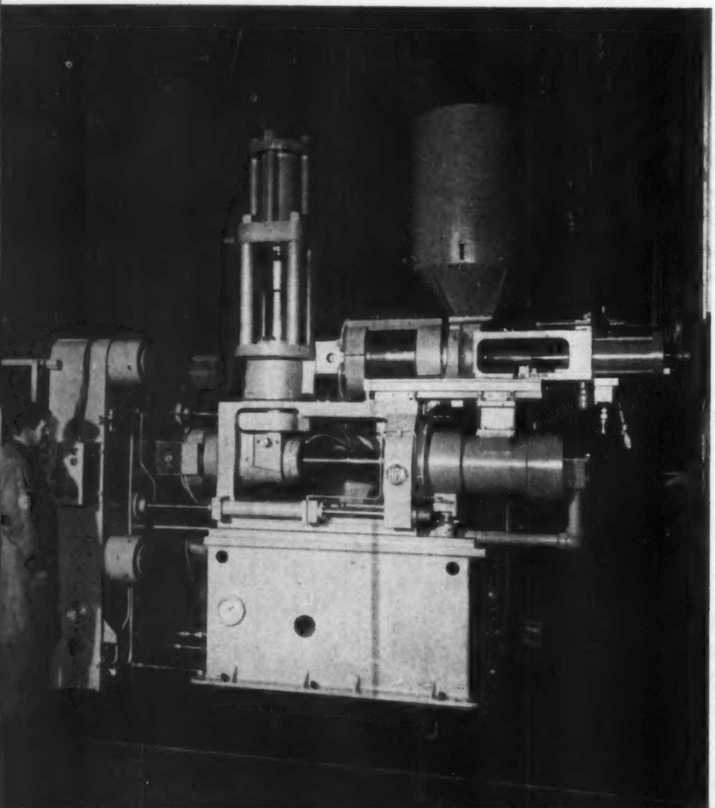
Simple Conversion

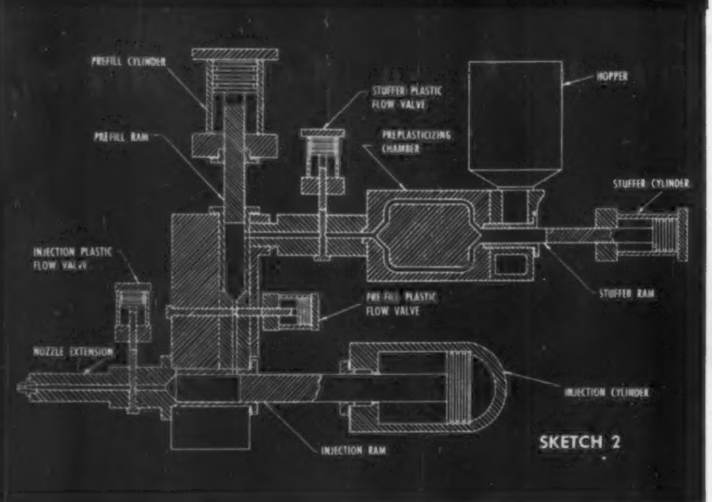
Molders who are now operating 9- and 16-oz. H.P.M. machines may equip them with preplasticizers without any machining or major mechanical changes; the two preplasticizer conversion units are designed for simple adaptation to their respective machines. The units are completely self-contained and mount on the injection cylinder strain rods.

Before conversion is made, it is necessary to remove the injection chamber and plunger, feed chamber, and feed mechanism and hopper from the machine. The conversion unit is then mounted directly on the injection cylinder strain rods in the same manner as was the feed chamber. The preplasticizer hydraulic power unit is then located on the floor adjacent to the machine, and pipe lines are connected between the power unit and preplasticizer. Minor electrical changes must be made in order to synchronize the injection unit with the mold clamp. An enclosed electrical panel, complete with pyrometer, timers, and other electrical control equipment, is furnished to minimize the electrical conversion problem. The same hydraulic cylinder and ram assembly which powered the injection plunger of the injection machine is used to reciprocate the injection plunger of the conversion unit.

200-Oz. Unit

The unit which increases the capacity of a 60-oz. machine to a minimum of 200 oz. is shown in the schematic drawing, Sketch 2, which illustrates the principle of its operation. The major components consist of a preplasticizer or stuffer, a hydraulic prefill unit, and a hydraulic injection unit. The preplasticizer is similar in design to that used for the 9- and 20-oz. conversion units in that both the stuffer or preplasticization chamber and the spreader are heated by electrical elements. However, in this unit, the stuffer does not feed softened material directly to the injection chamber. Rather, preplasticized material is fed first to





Diagrammatic sketch (bottom) of large preplasticizer which raises capacity of 60-oz. injection molding machine (on which it is shown installed, at top) to a minimum of 200 ounces. Major parts include stuffer, hydraulic prefill, and hydraulic injection unit. With one stroke of its ram, the prefill chamber, upper center, fills injection chamber

a prefill unit, where a volume of thoroughly preplasticized material is constantly stored during operation.

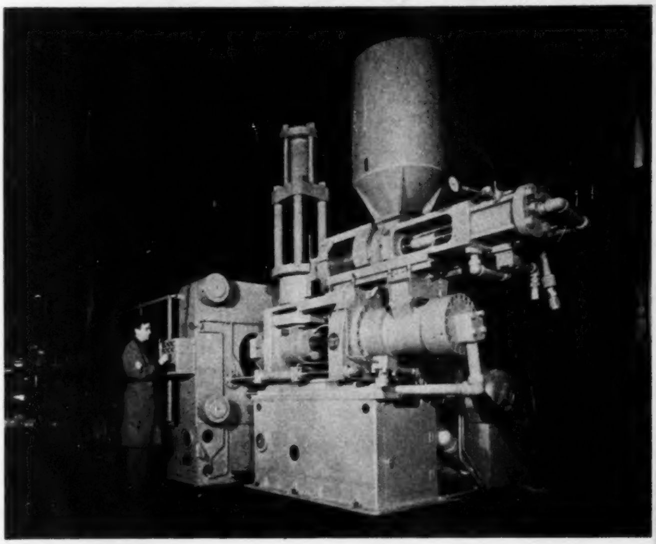
The stuffer discharge housing consists of a nitrated steel forging secured to the stuffer chamber, with joints ground and lapped to insure a perfect fit. A slide valve is mounted on this housing and the valve's plunger operates in it. This valve controls the flow of plastic material from the preplasticizing chamber and is normally in the open position, the term "open" meaning that the material is free to flow. The valve is closed only for the duration of each cycle of the prefill ram. This valve assembly is water cooled to counteract the flow of heat from its own Nitralloy plunger.

The stuffer discharge housing is provided with Calrod cast-in aluminum heating bands to keep the plastic material in a fluid state after it has been softened in the stuffer chamber. The hydraulic prefill unit consists of a double-acting ram which actuates the prefill plunger. This is a Nitralloy plunger which operates in a nitrided steel bushing. Mating with this bushing is a lower bushing.

In operation, the stuffer unit fills the prefill unit with plasticized material. During this part of the cycle, the prefill plunger is in a raised or retracted position, the stuffer slide valve is open, and the same type of valve installed in the discharge end of the prefill unit is closed. When the prefill cylinder is completely filled and when the injection piston is retracted and the cycle controller calls for the injection chamber to be filled, the stuffer valve will close, the prefill valve will open, and a third valve on the injection nozzle extension will also close. With all three valves in their proper position, the prefill piston then forces a charge of softened material into the injection chamber. This operation, performed with one stroke of the prefill piston, takes only a few seconds. Only during these very few seconds must the stuffer plunger remain inoperative.

Because the stuffer plunger of this unit can function at all other times, the plasticizing capacity of the stuffer is utilized practically to its full extent.

Limit switches are used in conjunction with each slide valve. They are connected electrically in such a way that operation of the pistons in the prefill chamber and injection chamber cannot occur when the valves are not properly positioned.



Power unit (lower right) for 200-oz. preplasticizer is located on floor, permitting easy accessibility. It is hydraulically connected to unit by flexible, high pressure hoses

Many Advantages

The use of preplasticizers offers many advantages to the injection molder. Not only are shot capacity and plasticizing capacity greatly increased, but the heating units are operated at lower temperatures. Because of this latter feature, there is less possibility of discoloring or burning the injection molding material. As a matter of fact, machines equipped with preplasticizers can be shut down and the heat left on even overnight, without danger of overheating the material in the machine. Further, the material itself is more uniformly plasticized, and there is no need for using measured feeding mechanisms.

The development of preplasticizers has gone a long way in increasing the possible size and weight of injection molded parts without resorting to injection machines of monstrous size.

Injection molding machine equipped with 200-oz. preplasticizer has a 1000-ton fully hydraulic mold clamp. Molds measuring 3 ft. 4 in. by 5 ft. can be used with this machine

Effect of Absorbed Water on Physical Properties of Molded Phenolics

by H. M. QUACKENBOS, JR.†

Formulas for the calculation of water absorption by molded phenolics for conditions of immersion and exposure to various humidities are presented. Laboratory results are given for expansion and change of properties with absorption. It is shown how the calculation of absorption can be combined with the laboratory results to allow an estimate, in practical situations, of dimensional stability, warping, and stresses.

THE absorption of water by plastics may be associated with the following effects of technical importance: 1) deterioration in mechanical and electrical properties and in appearance; 2) expansion and its accompanying phenomena — warping and stresses. The degree of warping or the magnitude of induced stress may be such that a molded part fails (e.g., cracking of wash drums used in rayon processing industry). Our main concern in this report will be with this second series of effects, although some results will be given for the deterioration in mechanical strength.

In the present tests for water absorption the gain in weight was determined for a disk 0.125-in. thick immersed in water for 24 hr. either at 25° C. (A.S.T.M. test) or at 100° C. This test is primarily for quality control but does give some comparison between materials. However, in practice, we often want to know how much water a molding of a given thickness will absorb after a certain time, and the test does not answer this question. In order to provide an answer, absorption has been followed over a period of time by other workers and their method is extended here to cover all thicknesses, times, and temperatures.

Absorption During Immersion

Conduction of heat and absorption of water are governed by similar principles. Thermal conductivity in heat conduction parallels diffusion constant, D, in water absorption.

The actual amount of water absorbed by a phenolic plastic immersed in water can be calculated for any thickness if the following are known: 1) diffusion constant, D, typical of the material; 2) the saturation constant, S, i.e., the maximum amount of water that can be held, again typical of the material, and 3)

* Reg. U.S. Pat. Office

† Development Dept., Bakelite Co., Div. of Union Carbide and Carbon Corp.

Table I—Typical Values for Absorption Constants and Expansion of Phenolic Molded Pieces in Water

Material designation	Resin type[a]	Filler	Diffusion constant, $D \times 10^{-5}$ at 24° C.	Saturation constant, S	Change per percent water absorbed: Length, K_l	Thickness, K_t
			$cm.^2 hr.^{-1}$	% by weight	%	%
A	2-step	Woodflour	0.32	8.4	0.23	0.5
B	2-step	Asbestos	0.9	1.2	—[b]	—
C	2-step	Woodflour + mineral	0.45	6.3	0.24	0.5
D	2-step	Fabric	1.5	5.4	0.13	0.7
E	1-step	Flock	1.7	4.0	0.22	0.4
F	2-step	Flock	0.9	6.8	0.19	0.7
G	1-step	Woodflour	0.7	6.6	0.23	0.5

[a] The two-step resins are all typical acid-catalyzed novolak resins, and the one-step resins are all typical alkaline-catalyzed heat-reactive resins. [b] Take as 0.2.

the temperature effect. A higher temperature quickens absorption, i.e., raises D, but does not affect the ultimate level, i.e., S. Values of D and S are listed in Table I; temperature effect is shown in Fig. 1.

The calculation of water absorption is normally complicated but is made simpler by using the following formulas and Fig. 2:

$$\% \text{ water absorbed} = \frac{pS}{100} \qquad (1)$$

where $p = \%$ read from the curve of Fig. 2 at time t, and

$$t = \text{given time (hr.)} \times \frac{D}{1 \times 10^{-5}} \times \left(\frac{0.125}{\text{given thickness}}\right)^2 \qquad (2)$$

where D = diffusion constant at given temperature.

Example 1 —How much water will be gained by a plate ¼ in. thick of type E material (one-step, flock-filled) immersed for 7 days at 70° C.? Solution: at 70° C., D is 5.2 times that at 24° C. (see Fig. 1). At 24° C., $D = 1.7 \times 10^{-5}$ (Table I). Hence at 70° C., $D = 5.2 \times 1.7 \times 10^{-5} = 8.8 \times 10^{-5}$. Therefore

$$t = 168 \times \frac{8.8 \times 10^{-5}}{1 \times 10^{-5}} \times \left(\frac{0.125}{0.25}\right)^2 = 370 \text{ hr.}$$

Hence, from Fig. 2, at 370 hr., $p = 44$. But $S = 4.0\%$ (Table I). Thus,

$$\% \text{ absorbed} = \frac{44}{100} \times 4.0 = 1.76.$$

Normally such an answer is not good to better than ± 20% of value.

Example 2—What is the gain of a plate ½ in. thick under the same conditions? Solution: By inspecting formula (2), we see that t now becomes 370/4 or 92.5 hr. and p from Fig. 2 is then 22%. Hence absorption = 0.88%. Increasing the thickness thus usually cuts the absorption in a given time. The important practical consequences of this will be touched on later.

With the above procedure, absorption is assumed to take place only through the two faces of the plate and not through the edges. The edges can be neglected only when both breadth and length are at least four times as great as the thickness. Otherwise the answer will be low although it will still be valuable in comparing materials.

As a matter of interest, actual curves of gain are compared for two materials in Fig. 3. They were determined simply by weighing disks, and D and S were calculated from the curves.

Absorption From Humid Atmosphere

If the relative humidity is 100%, D and S are the same as for immersion, and absorption can be calculated in just the same way as in Example 1. When the relative humidity is less than 100%, D still holds but S does not. Under conditions of average summer humidity, for example, the saturation value for material A (two-step, woodflour-filled) is 1.4% as compared with 8.4% in water. Until saturation values are determined for various humidities and temperatures, we cannot calculate exact answers as in Example 1. However, comparative answers within ±20% of value, can be found if we assume that the saturation values bear a fixed relation to those for immersion in water as previously indicated.

Example 3 — Compare the water absorption of material A (two-step, woodflour-filled) and material E (one-step, flock-filled) in Table I in thicknesses of 0.200 in. exposed to summer humidity. Solution: Assume period of summer is 90 days or 2160 hr. and temperature is 24° C. Let $S = k\ 8.4$ for material A, and $S = k\ 4.0$ for material E, where 8.4 and 4.0 are saturation values for immersion in Table I and k is some number less than 1 (probably about 0.2 for summer conditions based on experimental data). For material A, $D = 0.32 \times 10^{-5}$ and hence

$$t = 2160 \times \frac{0.32 \times 10^{-5}}{1.0 \times 10^{-5}} \times \frac{(0.125)^2}{(0.200)^2} = 270 \text{ hr.}$$

From Fig. 2, $p = 37.5\%$ and absorption = (37.5/100) k 8.4 = 3.15 k %. For material E, $D = 1.7 \times 10^{-5}$, t is calculated as 1435 hr., and $p = 80\%$. Absorption = (80/100) k 4.0 = 3.20 k %. The absorptions for materials A and E are thus almost identical (3.20 k % and 3.15 k %). Such comparative data are valuable as approximations even though absolute figures under those conditions cannot be calculated.

Example 4 — Compare the water absorption of materials A and E in thicknesses of 0.100 in., other condi-

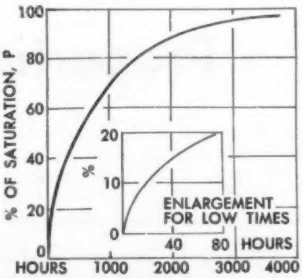
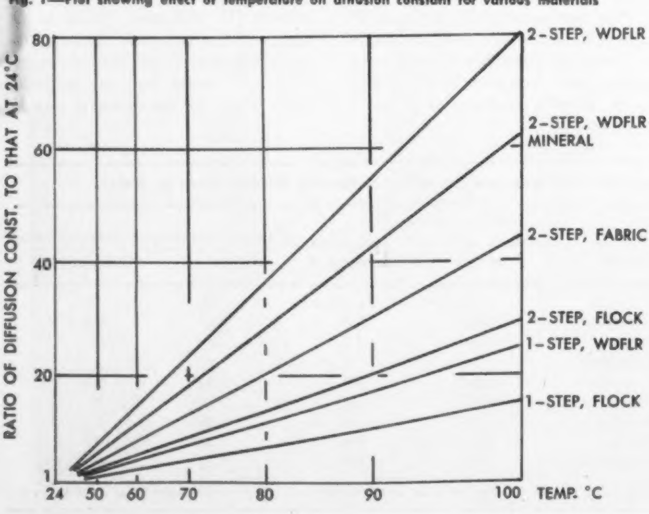


Fig. 2—Absorption for disk 0.125 in. thick when $D = 1 \times 10^{-5}$ cm.^{2}/hr.$^{-1}$

Fig. 1—Plot showing effect of temperature on diffusion constant for various materials



POLYESTER RESINS.........Dr. Earle Ebers

Ever since Dr. Earle Ebers delivered his comprehensive paper on polyesters at the National Technical Conference of the Society of Plastics Engineers earlier this year, wide interest in his report has been expressed.

For this reason, Naugatuck here reprints highlights of that report. As many of you know, Dr. Ebers and his Naugatuck associates are among the polyester pioneers who have contributed to the phenomenal growth of this remarkable resin.

If you wish the full text, the coupon below will bring it to you, along with the other data specified.

In 1942, polyesters, as we now generally know them, were born and a new class of thermosetting resins of the following properties was available:

• Good aging • 100% reactivity • Rapid curing without porosity • Wide viscosity range • Good chemical resistance • Good electrical properties • Good abrasion resistance • Wide color range • Good temperature shock resistance from −80° F. to 212° F.

In combination with fibrous fillers such as nylon, cotton, sisal, rayon, paper and, in particular, glass, polyesters have the above properties plus:

• High specific tensile and flexural strength
• High impact resistance

WAR USES: The handling properties of low viscosity, 100% reactivity and rapid curing without porosity under no or a minimum pressure permitted that American production ideal of continuous operation in the lamination of glass cloth. Large quantities of sheet stock of this nature were made. These were used as support panels for self-sealing gasoline tanks in aircraft.

More complex aircraft structures such as air scoops, water and de-icer tanks, wheel farings and ducts quickly followed as experience with these versatile polyester resins grew because they gave:

• Weight savings • Elimination of costly tooling • Man and machine hour savings • Versatility

The excellent physical and dielectric characteristic of these laminates were utilized in radomes.

WAR DEVELOPMENTS: Experimentation on structural sections such as the BT-15 airplane fuselage by the AAF Material Command, Wright Field, clearly demonstrated that polyester fibre glass laminates compared to metals and, in particular, 24 ST aluminum have:

• Higher specific strengths • Greater damping capacity • Better thermal insulating properties • Better acoustical insulating properties • Possible fabrication advantages in time savings and simplified structures • Greater adaptability to variable gauge sections

These advantages were further borne out when the constructions of the Sikorsky Aircraft B-6 Helicopter cabin was changed from metal to plastic with:

• Over 10% saving in weight • Greatly reduced noise level • A reduction in parts to assemble from several hundred to only 26 • Approximately a 50% reduction in production time

Simple boat structures were a "natural" and appeared early on the scene.

A great developmental saga had been written and enthusiasm was rampant for the post-war possibilities of this Cinderella when the war came to a close and the fairy godmother was gone.

Polyester resin sales rose from perhaps 1,500,000 pounds in 1946 to 7-8,000,000 pounds in 1950 and these resins were used in the following amazing variety of products.

CONTINUOUS LAMINATIONS: This was probably the first and simplest conversion: Two polyester-bonded glass cloth products finding peacetime usage as cargo liner and photo template. Immediate introduction of a paper laminate into the wall board and decorative table top field also helped to absorb some of the capacity of these machines.

CAST SHEET AND TUBING: Abrasion resistance and good optical clarity are utilized for glazings, while the excellent electrical characteristics of these resins lead to parts for electronic and radar equipment. Further, they replace more expensive amber in x-ray equipment.

FISHING RODS: By applying the very high strength-to-weight ratio of polyester-bonded parallel glass fibres to rod-making, in analogy with the natural bamboo product, this new fisherman's delight was born.

BOATS: This application was a logical extension of the armed services' experimentation in this field. With new techniques, commercial boats of more versatile design are being built with 45 to 90% savings in man-hours. Other plusses are lighter weight, salt water resistance, imperviousness to rot and worms, no annual caulking and high impact resistance.

LUGGAGE AND CARRYING CASES: The abrasion resistance, high strength properties, light weight and integral color lend themselves to attractive carrying cases for musical instruments and luggage.

AUTOMOTIVE: Lightweight, ease, and economy of repairs are the main advantages. Competitive costs have only been obtained to date in cases such as trailer fenders and electric cruising car bodies where the total of pieces required was small.

SEALANT FOR POROUS CASTINGS: Excellent against petroleum products and thermal shock.

LAMP SHADES: High light transmission permits lower wattage bulbs. Easy cleaning, strength and resistance to heat and moisture are other features.

OUTDOOR SIGNS: Good weathering, toughness, lightweight and integral color contribute to low maintenance costs.

STREET LAMP GLOBES AND REFLECTORS: Toughness towards sharp stones, good light reflectance, and good weather resistance make this a highly practical application.

TRUMPET MUTES: This is a typical example of the hollow articles which might be made in a single piece, having no joints to develop weakness under continuous vibration.

PROJECT TOOLS: Polyester glass laminate project tools in the aircraft industry give large time and money savings over metal tools and do a better job. They are less liable to distortion and damage in service.

LARGE PIECES: That size is no limitation to polyester glass laminate structures is evidenced by the 650-pound synchroton piece and the 700-pound Westinghouse photometer sphere made from them. High strength, good dimensional stability, excellent electrical properties and weight savings are additional features.

MOLDINGS: The fast curing of polyesters has given molding compounds for the electrical industry—with very high tracking resistance and 30-90% greater productivity. Other special formulations give rapid production of television antenna holders and tough, colorful battery boxes.

FUTURE OF POLYESTERS:

Now comparative to the technology of woods and some metals, the chemist and engineer have hardly turned the first pages in their thinking on polyesters and polyester fibre combinations. If, as established in the 1946-1950 period, these are already competitive in many cases, can there be doubt as to their future potentialities?

Structures from buttons to atom smashers, flat sheet to B-29 duct work, and work trays to radomes, attest to the handling and physical properties and versatility of these materials.

In conclusion, it is suggested that application of your creative imagination and ingenuity to these materials will yield high rewards similar to those attained by the dreamers of 1944 and 1945, a large percentage of whose ideas are now commercial realities.

Table II—Effect of Water on Mechanical Properties of Molded Phenolics

	One-step, flock-filled, immersed 25 days at 84° C.	*Two-step, woodflour filled, immersed 10 days at 84° C.*
Gain in weight (tensile specimen, ⅛ in. thick), %	2.8	7.7
Loss in tensile strength, %	15	60
Gain in weight (flexural specimen, 5 by ½ by ½ in.), %	2.6	6.7
Loss in flexural strength, unnotched, %	19	53
Loss in flexural strength, notched, %	2	31
Loss in flexural modulus, %	17	53
Loss in flexural work to break[a], unnotched, %	28	54
Loss in flexural work to break, notched, %	0	19 (gain)

[a] Flexural work to break is a measure of impact resistance.

tions being as in Example 3. Solution: For material A, t now becomes 1080 hr., $p = 72\%$, and absorption is 6.05 k %. For material E, $t = 5740$ hr., $p = 99\%$, and absorption = 3.96 k %. Under these conditions material A absorbs about 50% more than material E. Note also that the lowering of absorption attending the increase in thickness (from 0.1 to 0.2 in.) is very marked with A but is scarcely worth while with E.

The above procedure holds only if water is gained. The calculations cannot be made if water is lost in a drying atmosphere.

Changes Accompanying Absorption

Absorption of water is accompanied by expansion along the length, breadth, or diameter as expressed by K_l in Table I and to a greater extent along the thickness as expressed by K_t. Orientation of filler may account for the difference between K_l and K_t. At temperatures above 80° C., there is a tendency to blister during absorption, and average increase in thickness is higher.

Results are given in Table II for tensile bars (⅛ in. thick) and flexural bars (5 by ½ by ½ in., unnotched and containing molded notches) exposed to water at 84° C. for 10 days (two-step, woodflour-filled) and 25 days (one-step, flock-filled). In general there is a decline in properties of the same order of magnitude for tensile strength, flexural strength (unnotched), flexural modulus, and impact resistance (unnotched, i.e., flexural work to break, unnotched). The change for notched values is less regular.

From these and various other results for cellulose fillers, it appears that the four properties mentioned above decline about 7% for each percent of water absorbed, regardless of the time and temperature of exposure and the material. This semi-quantitative rule, of course, may be invalidated when more materials are examined.

Plate Absorbing From Both Sides

Dimensional changes can be calculated by combining the water absorption with the changes per percent absorbed with a precision of about ±30%.

Example 5—What are the dimensional changes for a plate of material E (one-step, flock-filled) in Examples 1 and 2? Solution: In Example 1, absorption = 1.76%. Change in length per percent absorption = 0.22% (Table I). Hence gain in length of plate = 1.76 × 0.22 = 0.386% (i.e., 0.00386 in./in. of length). Change in thickness = 1.76 × 0.4 = 0.70% = 0.0018 in. for a thickness of ¼ inch. The decline in certain properties = 1.76 × 7 = 12.3% approximately. In Example 2, absorption = 0.88%. Gain in length of plate = 0.193%. Change in thickness = 0.88 × 0.4 = 0.352% or = 0.0018 in. for a thickness of ½ inch. The decline in certain properties = 0.88 × 7 = 6.2% approximately. (These properties are tensile and flexural strength, flexural modulus, and unnotched impact resistance).

Note that for a fixed length the thicker plate is more dimensionally stable in length but the actual gain in thickness is about the same for both thicknesses (0.0018 inch). Changes could also be calculated for Examples 4 and 5 in terms of k and would thus be of value for comparing materials.

A plate absorbing water from both sides expands but does not warp. (Warping will occur if absorption is greater on one side than another, which is discussed in the next section.) Internal stresses are usually present in a plate absorbing water because the outermost wet fibers tend to expand while the drier inner fibers resist expansion. At each outer surface the stress is in compression and at the center it is in tension. Further analysis can be supplied in those probably rare examples where these stresses may be suspected of causing failure.

Plate Absorbing Water From One Side

The most important change is warping, and this tends to occur when the two sides of a plate are exposed to different humidities. In the simplest case one side is against water while the other side is dry. The wet fibers tend to elongate and

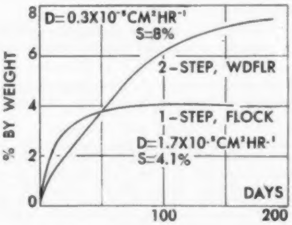


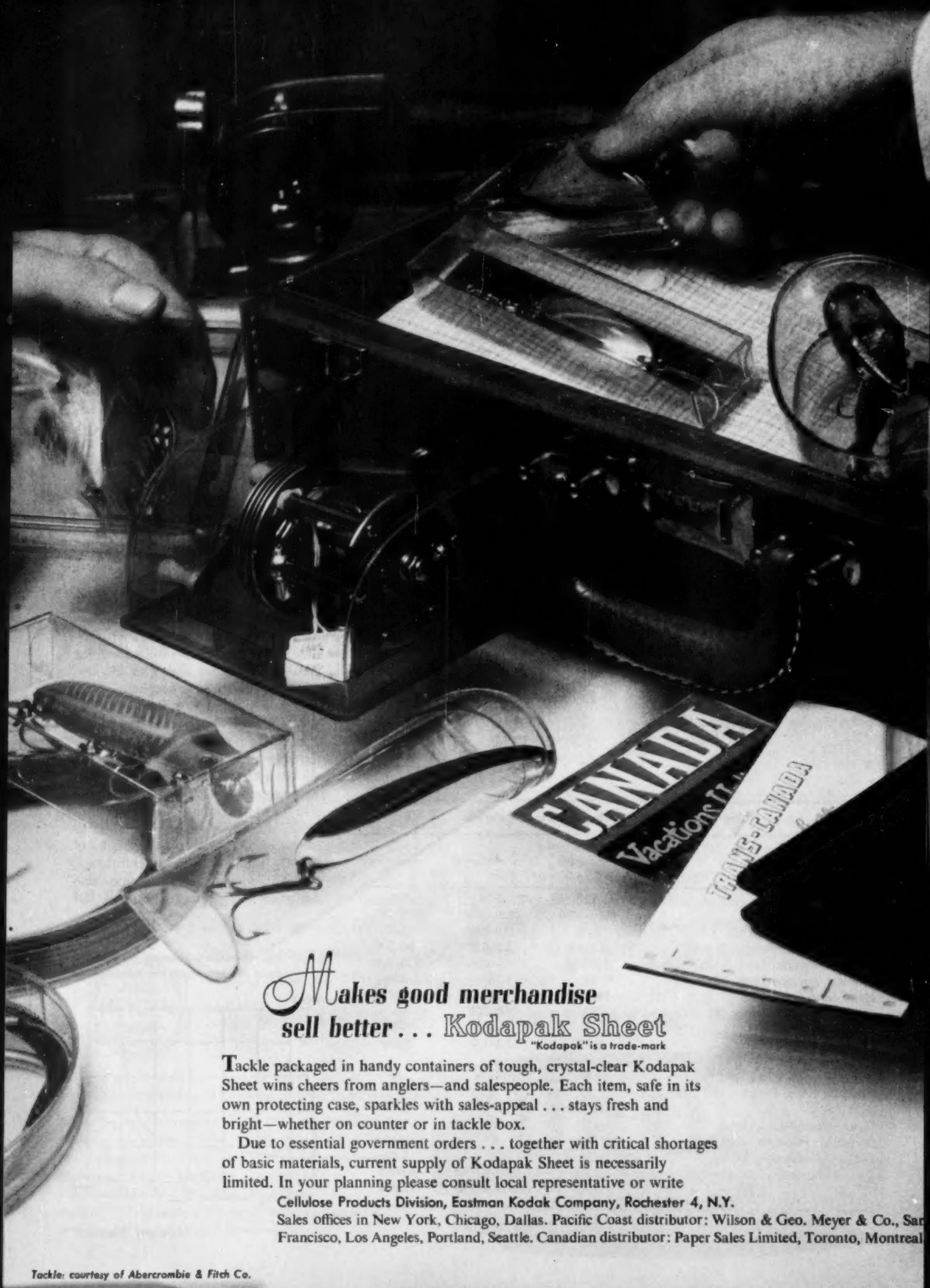
Fig. 3—Absorption in water of ½-in. disks of two materials held at 25° C.

the dry ones to remain unchanged. The plate accommodates these tendencies by warping, the dry side becoming concave. The extent of warping as a function of time and the constants of the material can be expressed in Fig. 4 as the ratio d/d^1 where d = actual deflection with respect to a plane through the four corners of the plate, d^1 = maximum deflection attainable =

$$\frac{K_1 S b^2}{8L}\left[1+\frac{W^2}{b^2}\right]$$

where L = thickness, in.; b = breadth, in.; W = length, in.; K_1 = percent change in length per percent water absorbed (see Table I); and S = saturation water content in percent.

(*Continued on p.* 170)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Unplasticized Polyvinyl Chloride

By NORBERT PLATZER *

Unplasticized polyvinyl chloride is characterized by mechanical strength and corrosion resistance. It is well suited for the fabrication of plant equipment in the chemical industry and allied fields. German practices in the manufacture of moldings, rods, pipes, sheeting, film, bristles, and fiber by the techniques of rolling, calendering, laminating, molding, extruding, and spinning are described in this article.

IN 1944, 63 million lb. of polyvinyl chloride were manufactured in Germany; 75% was used plasticized as a replacement for rubber, 5% unplasticized for fibers, bristles, and films, and 20% unplasticized for rigid piping and lining material in the chemical, food, textile, and other industries where corrosion resistant properties are required. In the other European countries and in the United States, rigid polyvinyl chloride has only recently been commercially exploited (1)[1].

The properties of rigid polyvinyl chloride material in sheet, rod, and tube form as used for corrosion resistant equipment are listed in Table I and are compared with those of polyethylene. The mechanical properties deteriorate with increasing temperature, as polyvinyl chloride is a thermoplastic material. It is, therefore, recommended for use at temperatures only below 60° C. The decreases in impact strength and tensile modulus of elasticity with temperature are shown in Fig. 1 and 2. The resistance of polyvinyl chloride to a large number of acids, alkalies, organic solvents, and gases are reported by W. Buchmann (2).

The properties of stretch oriented unplasticized films, bristles, and monofilaments are compared with other materials in Tables II, III, and IV.

Extrudable Unplasticized PVC

The degree of polymerization (3) of polyvinyl chloride can be varied by changing the temperature of polymerization (Fig. 3). Low as well as high molecular weight polyvinyl chloride can be processed into unplasticized films and laminated sheets. For extruding through screw or ram extruders where good flow characteristics are required, only low molecular weight grades, polymerized at or above 60° C., are considered suitable.

To facilitate the flow of the resin, small quantities of lubricants are required, such as waxes, stearic acid, octadecyl alcohol, ceresin, or the higher alkyl polyvinyl ethers. In addition, to prevent break-down of the resin, small amounts of heat stabilizers, such as lead, tin, and cadmium salts or organic compounds, have to be added. Some of the products, e.g., calcium stearate, act both as lubricant and stabilizer.

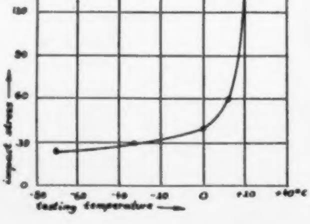
The German unplasticized extrusion grades were polymerized in suspension using 50% Ampho soap (sodium oxoctadecane sulfonate) as emulsifying agent and 1 to 2% sodium carbonate or phosphate. After polymerizing, the suspension was spray dried (4) whereby the added substances remained in the resin. To extrude this stabilized resin, the addition of only 1 to 2% of lubricant was necessary. During and after the war, when Ampho soap was not available, other compounds, such as Mersolat (hydrolysis product of C_{14}-C_{18} aliphatic sulfonyl chlorides), Nekal (sodium dialkyl naphthalene sulfonate), Talvon (sulfonated tall

* Plastics Div., Monsanto Chemical Co.
[1] Numbers in parentheses link to references on page 178.

Table I—Physical Properties of Various Materials

Property	Unplasticized polyvinyl chloride	Polyethylene	Polystyrene
Specific gravity	1.38	0.92	1.06
Tensile strength, p.s.i.	8000-9000	1500-2500	6000-7000
Elongation at break, %	6-40	150-250	1-6
Modulus of elasticity, 10^5 p.s.i.	3.3-3.8	0.1-0.2	4.0-5.0
Impact strength, Izod, ft.-lb./in. notch	0.3-0.76	———	0.25-0.40
Normal working limit, °F.	140	160	170
Heat distortion, °F.	140-160	170	170-210
Heat seal temperature, °F.	350	250-300	———
Brittle point, °F.	0	-90	-80
Flammability, in./min.	self-extinguishing	1.1-1.4	Slow
Thermal expansion, 10^{-5}/°C.	8	16-18	19
Thermal conductivity, BTU/hr./ft.^{2}/in./°F.	2.1-2.5	2.96	1.45
Volume resistivity, ohms	10^{15}	10^{17}	10^{17}
Dielectric strength, volts/mil	750	460	600
Dielectric constant, 10^3 cy.	3.5	2.3	2.45
Dissipation factor, 10^3 cy.	0.018	0.0002-0.0003	0.0003
10^6 cy.	0.019	0.0003-0.0005	0.0004

Fig. 1—Impact strength of unplasticized PVC at varying test temperatures



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oil), and Rewa (lactone of butyraldehyde condensation product) were used. These emulsifying agents did not act as stabilizers, and for extrusion the addition of 1 to 2% lubricant and 0.5 to 2% heat stabilizer was required. One of the main factors in producing a satisfactory extrusion compound is good distribution of the stabilizer and lubricant in the resin. This can be brought about by ball milling for several hours or by adding the compounds during the course of polymerization.

Various colors are obtainable in the extruded articles by adding different stabilizers or pigments. Sodium salts, such as sodium carbonate, phosphate, or fluoride, give the well known reddish-brown color of German Vinidur; lead stearate results in white-milky products; and dibutyl tin maleate or ethyl amino isopropionate result in translucent articles.

Soluble PVC

Straight polyvinyl chloride is soluble only in a few organic solvents, such as cyclohexanone, cyclopentanone, methyl ethyl ketone, isophorone, pyridine, tetrahydrofuran (5) or carbon disulfide (6). To bring about solubility in acetone for film casting or dry spinning, two methcds can be employed: 1) copolymerization of vinyl chloride with vinyl acetate, acrylates, methacrylates, acrylonitrile, maleic anhydride or vinylidene chloride, or 2) after-chlorination. The first method is well known in this country, but has the disadvantage that the copolymer has a lower softening point than the straight polyvinyl chloride. Only the copolymer of vinyl chloride with a high percentage of vinylidene chloride is characterized by a higher softening point.

After-chlorination of the straight polyvinyl chloride has been carried on in Germany since 1939 (7). The dry polyvinyl chloride (chlorine content 56.8%) is gelatinized in tetrachloroethane (10% solution) and chlorinated without any catalyst between 60 and 115° C., resulting after 24 to 40 hr. in a soluble product containing 64 to 66% chlorine (8) and of higher molecular weight than the

Table II—Comparative Properties of 1-Mil-Thick Films

	Luvitherm UG	*Luvitherm G*	*Vinylite VB-1300*	*Saran 517*	*Polythene*
Chemical Type	Polyvinyl chloride	Polyvinyl chloride	Copolymer v.c./v.acet.	Copolymer vinylidene	Polyethylene
Method of manufacture	Calendering	Calendering & stretching	Casting	Extruding	Inflated tube extrusion
Manufacturer	I. G. Farben.	I. G. Farben.	Bakelite	Dow	Visking
Surface area, sq. in./lb.	20,000	20,000	21,600	16,300	30,100
Yield strength					
Lengthwise, p.s.i.	7700-8100	14,500-16,300	10,000-10,600	10,300-13,200	1200-1500
Crosswise, p.s.i.	7650-8100	————	9900-10,600	6300-11,100	1200-1400
Break strength					
Lengthwise, p.s.i.	6800-7200	20,500-26,500	8500-10,200	10,200-13,200	1900-2100
Crosswise, p.s.i.	6300-6500	7700-8100	7800-8700	6300-11,100	1500-2000
Yield elongation					
Lengthwise, %	4-5	4-5	3-5	22-38	28-35
Crosswise, %	3.5-4.5	—	5-35	15-38	13-20
Elongation at break					
Lengthwise, %	39-100	25-50	5-35	22-38	210-280
Crosswise, %	5-14	3.5-4.5	5-35	15-38	380-520
Modulus of elasticity					
Lengthwise, 10^5 p.s.i.	3.3-4.0	4.7-7.9	2.5-3.5	0.6-0.7	0.12-0.20
Crosswise, 10^5 p.s.i.	3.2-3.8	3.0-3.7	5.2-6.0	0.7-0.9	0.16-0.26
Bursting strength (Mullen) p.s.i./mil	27-40	29-34	35-37	34-48	3.9-4.1
Tear strength (Elmendorf)					
Lengthwise, g./mil	24.5-25.5	7-7.5	18-19	17-18	76-92
Crosswise, g./mil	53-60	400-1400	18-20	18-20	140-160
Folding endurance (M.I.T.)					
Lengthwise	11,000-17,000	41,000-43,000	1700-5100	>70,000	>150,000
Crosswise	4500-7100	900-1600	1300-4000	>70,000	>150,000
Water absorption, %	0.05	0.05	0.08	< 0.01	0.005
Water vapor permeability at 100° F., g./24 hr./100 sq. in.	4	4	6	0.25	1.1
Gas permeability at 77° F., cc./24 hr./100 sq. in.					
Carbon dioxide	337	337	546	25	1650
Nitrogen	14.3	14.3	27.3	1.4	160
Oxygen	70	70	102	6.4	390
Air	30.6	30.6	45	1.5	—
Light transmission at 550 mμ, %	89.3	90.1	91.5	89.7	89.4
Haze at 550 mμ, %	7.4	7.7	3.4	0.6	14.5
Refractive index, n_D	1.53	1.53	1.52	1.602	1.51

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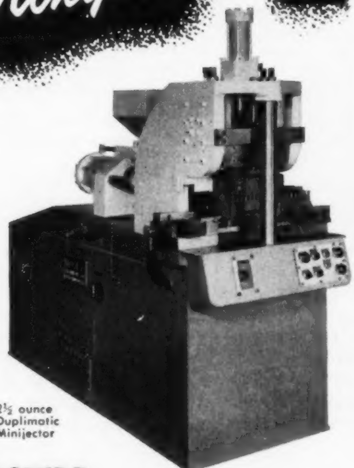

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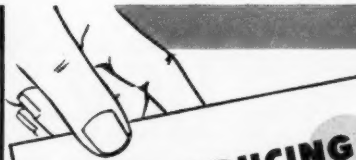

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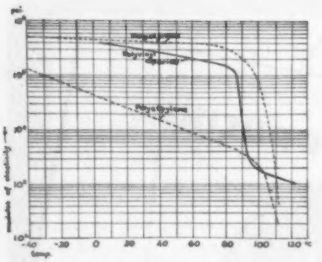

Fig. 2—Effect of temperature on modulus of elasticity for various plastics

initial polymer. It corresponds to a copolymer of 2 parts vinyl chloride and 1 part vinylidene chloride. The additional chlorination step is generally more expensive than the direct copolymerization.

Roll Milling

Unplasticized polyvinyl chloride—with or without lubricants and stabilizers—is thermoplasticized by roll milling. This treatment precedes, with a few exceptions, all final processing. The fresh powder is added to previously thermoplasticized material to avoid too much material dropping through the rolls and having to be shoveled back. Polyvinyl chloride of small particle size and low molecular weight generally sticks best to the rolls. After 5 to 10 min. a plastic crepe is formed, cut from the rolls, and removed as a billet. This operation is repeated four or five times either on the same roll or on a series of rolls. The last sheet is rolled to a billet of 12 to 25 lb. weight for calendering or ram extrusion, cut into small strips for normal extrusion, trimmed to square sheets 0.01 to 0.05 in. thick for laminating, or cooled down and broken to pea size flakes in a cage mill for injection molding.

It is essential that the milling be conducted at the optimum plasticizing temperature, which depends on the molecular weight (Fig. 4). A working temperature of 150 to 160° C. is sufficient for a polyvinyl chloride grade of K-value 60 to 65, but a temperature of 180 to 190° C. is necessary for the higher molecular weight product of K-value 80, requiring more care. The range between working temperature and decomposition temperature is so narrow that a rise of only 5° C. can cause rapid blackening of the plastic. But rolling below the plasticizing temperature produces a brittle plastic of poor impact and tensile strength, similar to that described by Liebhafsky, Marshall, and Verhoek (9).

Calendering

Film and sheeting of 0.02 to 0.001 in. thickness are made on three- or four-roll calenders (10). Sheeting 0.02 in. thick is used as tank lining (11) and is stuck to the walls with a 10% solution of after-chlorinated polyvinyl chloride or vinyl chloride copolymer. Acid- and alkali-proof filters (Decelith) are made by placing glass wool between two perforated polyvinyl chloride sheets (12). Corrugated and perforated sheets are also used in the manufacture of

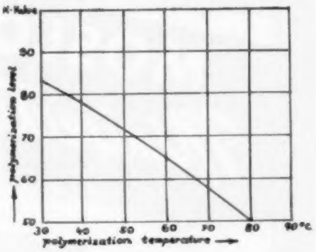

Fig. 3—Effect of polymerization temperature on the degree of polymerization

batteries to prevent falling out and shorting of the active mass from the lead plates and reduce the total battery weight 35 percent. Sheeting of 0.01 in. thickness is used as a lining for cans (13). Such linings stand 120° C., the temperature of sterilization. Thin calendered film is used for packaging purposes or is coated on paper or cardboard for use in the manufacture of tubes or other containers, or on cork disks for bottle caps.

To increase the mechanical properties in one direction and to make films of 0.001 in. thickness or less, the calendered film is stretch oriented in a special machine—Luvitherm (14). The film leaving the calender with a speed of 26 to 36 ft./min. is trimmed on the edges with circular rotating knives to provide even thickness and width. The stretching device consists of two main horizontal rolls (16 in. diameter by 28 in.), which are mounted above each other, and several small

Table III—Comparative Properties of Synthetic Bristles and Monofilaments

	PCU[a]	*Vinylite*[b]	*Velon*[b]	*Nylon*	*Perlon*	*Polystyrene*[b]	*Drawinella*	*Polythene*[c]
Chemical type	Polyvinyl chloride	Copolymer vinyl chloride acetate	Copolymer vinylidene vinyl chloride	Polyamide	Polyurethane	Polystyrene	Cellulose acetate	Polyethylene
Manufacturer	Agfa (Germany)	Polymers, Inc.	Firestone	Du Pont	Agfa (Germany)	Polymers, Inc.	Wacker (Germany)	Reeves Bros.
Specific gravity	1.38	1.27	1.68	1.15	1.15	1.06	1.27	0.92
Tensile strength, p.s.i.	13,800	34,500	40,000	50,000	49,000	11,900	30,100	18,000
Elongation at break, %	55	24	25	25	42	1.5	12.5	100
Modulus of elasticity (stiffness), 10^5 p.s.i.	5.0	5.0	—	4.5	4.0	10.8	6.6	0.5
Water absorption, %	0.05	0.05	0.05	1.5	3.0	0.3	6.5	0.005
Softening point, °C.	88	65	118	242	—	116	—	90
Melting point, °C.	—	—	—	262	—	—	—	110
Resistance to heat, °C.	68	55	77	100	100	77	105	50
Resistance to cold, °C.	-18	-25	-40	-70	-70	-62	-18	-40

[a] 2:1 stretch; [b] 4:1 stretch; [c] 6.1 stretch.

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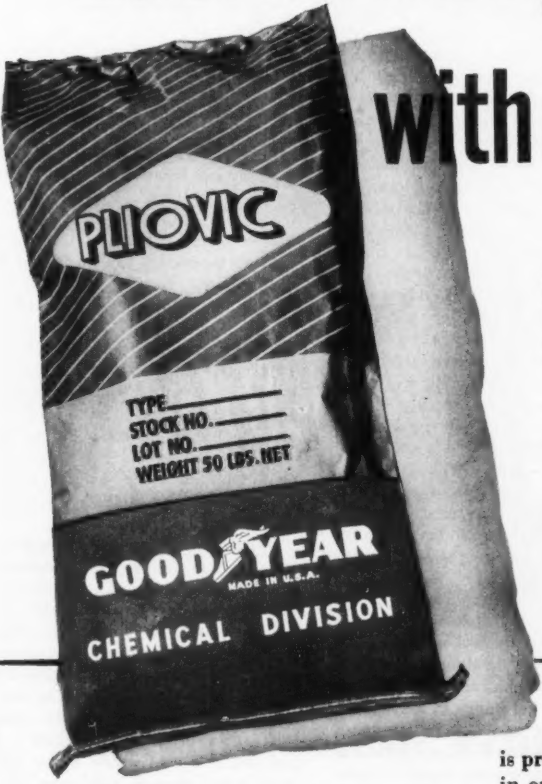

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rolls. The film is heated for a short period above its softening point on the first main roll at 240° C. By increasing the speed to 46 ft./min. between hard rubber pull rolls, the softened film is stretched. The following non-rotating main roll is maintained at 125° C. and furnished with spreader channels to allow decrease of the film in thickness but not in width. The film is stretched about 270% by increasing the speed of the following cooling rolls. The production capacity of such a machine is about 30 to 45 lb./hr. of film 2 ft. wide.

The stretch oriented film is usually slit into tapes ⅜ in. in width. Due to high breakdown voltage and arc resistance, these tapes are used as insulation for electric wire. The low solubility of polyvinyl chloride allows covering of the wrapped cables with plasticized polyvinyl chloride by extrusion. The tapes are also used for phonographic reproduction, either as embossed tape for use with a sapphire needle or coated with magnetic iron oxide for electromagnetic reproduction. The advantage of the latter is that a complete opera may be heard from a single tape and that the tape can be reused after demagnetizing has been accomplished.

Experiments were made to stretch the material in two directions. The machine for the second stretching consisted of a heated half cylinder over which the film, already stretched in one direction, was drawn and stretched across by travelling in tenting grooves on disks set at an angle with the axis of the cylinder. The edges of the film were held in the grooves by strings. This film exhibited excellent mechanical properties in both directions.

Laminating

The maximum thickness to which unplasticized polyvinyl chloride can be calendered to give a sheet of smooth surface is 0.02 inch. In order to build up thicker sheets or blocks the premilled crepe sheets are pressed together. In 1944, 500 tons/month of such Vinidur sheets were produced in Germany; analogous sheets are now made under the trade-name Nutradur in Britain, and under the trade-name Lucoflex in France and the United States.

The hydraulic presses furnished with 6 to 12 movable platens have a maximum available molding pressure of 2500 to 10,000 p.s.i. and are heated to 165 to 190° C. (according to the molecular weight of the resin), followed by cooling with water (30 min. for heating and cooling of 0.25-in. thick sheet). Several plants are equipped with double presses, one for heating and one for cooling. The hot polyvinyl chloride between two steel sheets is transferred immediately from the hot into the cold press after releasing the pressure. The maximum thickness that can be made by laminating presses heated by steam or high pressure water is 6 in.; thicker sheets are made by high frequency heating.

Thicker blocks can also be made by molding hot billets in a hydraulic press. The blocks can be machined on lathes and sawed and planed in wood and some light metal working machines.

Molding

Compression molding—The simplest molding technique is to preheat the weighed charge of polyvinyl chloride powder or broken premilled flakes about 45 min. at 140° C., charge it into the heated mold, close the press slowly (1 to 1.5 min.), hold it under pressure (about 10,000 to 12,000 p.s.i) for a short period at 165 to 175° C., and then cool down below 50° C. before releasing the pressure and opening the mold. Simple shaped articles, such as battery cases, decontamination boxes, and photographic developing tanks, are made by this method (15).

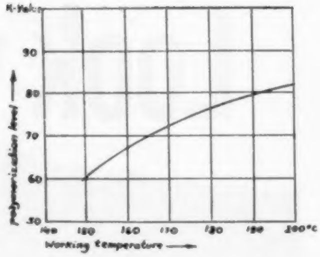

Fig. 4—Polymerization effect on plasticization temperature in roll milling

Impact molding—This modified compression molding was developed in Germany (16). The polyvinyl chloride powder is compressed into pellets, heated for 20 min. in a rotating oven at 200 to 210° C., and transferred rapidly into a cold mold which is closed with a fast stroke. The article is taken out of the mold when it is reasonably hard (below 50° C.) and put into cold water. Valve casings, screw threads, ash trays, pipe stems, and the like, are made by this method. It is possible to place two or three pellets upon each other, but the size of the completed article is limited.

Transfer Molding—Larger articles, such as T-pieces or wide valve casings of about 1 lb. weight are made by preheating the polyvinyl chloride powder or billets in a transfer chamber up to 165° C. for 10 min. and forcing the material by means of a ram into a split hot mold. The mold is maintained for 1 min. under pressure and then cooled down within 5 min. to 50 to 60° C.

Injection Molding—It is not possible to produce satisfactory articles of unplasticized polyvinyl chloride in standard injection machines, because it does not flow so easily as polystyrene or cellulose acetate

(*Continued on p.* 173)

Table IV—Comparative Properties of Synthetic Fibers

Fiber	*Softening point*	*Tensile strength*	*Elongation*	*Flexibility index*
	°C	g./den.	%	
Straight polyvinyl chloride (Vinnol)	88	4.16	11.1	200,000
After-chlorinated polyvinyl chloride (PeCe)	100	1.8-2.2	24-46	200,000
Copolymer vinyl chloride acetate (Vinyon)	65	2.5-3.0	19-47	——
Polyurethane (Perlon)	225	4.5	22-30	244,000
Polyamide (Nylon)	250	5.0	16-62	——
Silk	—	4.7	12-24	76,000
Cotton	—	2.2-4.5	7-10	65,000
Wool	—	1.3-1.9	20-50	156,000

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PLASTICS DIGEST*

Abstracts from the world's literature of interest to those who make or use plastics or plastics products. Send requests for periodicals to the publishers listed.

Materials

Plastics From Natural Rubber. G. Salomon, G. J. van Amerongen, G. J. van Veersen, G. Schuur, and H. C. J. de Decker. Ind. Eng. Chem. *43,* 315-19 (Feb. 1951). Methods for the preparation of rubber derivatives from acid-stabilized natural latex are discussed. Soluble chlorinated rubbers of high chlorine content (up to 70%) are obtained by means of an after-treatment of latex-chlorinated rubber. Rubber hydrochloride from latex is a powdery product with a high degree of crystallinity. Part of this crystallinity persists even near the decomposition temperature at 130° C. Therefore, processing methods have to be adapted to these general properties, which resemble those of saran. Several applications were developed. Cyclized rubber from latex—which is a thermoplastic, finely divided powder—can be processed with softeners of the paraffinic oil type and with cheap fillers. It differs from the known derivative by its remarkable reinforcing effect on rubber when mixed in the form of a latex with rubber latex.

Sulfonated Cross-Linked Polystyrene: A Monofunctional Cation-Exchange Resin. K. W. Pepper. J. Applied Chem. *1,* 124-32 (Mar. 1951). Recent improvements in the performance of ion-exchange resins are illustrated by an account of the preparation and properties of sulfonated cross-linked polystyrene. The copolymerization of styrene and divinylbenzene in bead form is described. Cross-linked polystyrene is sulfonated by heating the copolymer with concentrated sulfuric acid at 100° C. in the presence of silver sulfate. After a time depending on the particle size and divinylbenzene content of the copolymer, the exchange-capacity of the product attains a limiting value which corresponds to the formation of a monosulfonic acid. Sulfonated cross-linked polystyrene is a hygroscopic gel; its swelling and shrinkage in water and aqueous solutions are markedly dependent on the degree of cross-linking. The cation-exchange properties of the resin are consistent with those expected of a monofunctional, strongly acidic material. The influence of the extent of cross-linking on the relative affinity-coefficients and rates of exchange of sodium and hydrogen ions are indicated.

Aliphatic Acid Esters of Cellulose. Properties. C. J. Malm, J. W. Mench, D. L. Kendall, and G. D. Hiatt. Ind. Eng. Chem. *43,* 688-91 (Mar. 1951). Data on melting point behavior, moisture sorption, density, tensile strength, refractive index, solubilities, and specific rotation for a series of cellulose esters from acetate through palmitate are presented. The esters used were fully esterified and had substantially the same degree of polymerization. As the number of carbon atoms in the acid increases, density, tensile strength, specific rotation, and moisture sorption decrease. The melting points pass through a minimum at the C_8 ester, while maximum solubility is reached with the C_8 or C_6 esters. The refractive index varies only slightly throughout the series.

Polyesters. E. S. Ebers. SPE J. 7, 31-3 (Feb. 1951). Properties and applications of polyesters are reviewed.

Some Further Uses of Maleic Anhydride in the Preparation of Synthetic Resinous Polymers. R. S. Robinson. Plastics Inst. (London) Trans. *18,* 20-9 (1950). Resins formed by reacting maleic anhydride with aldehydes and ketones are described.

Properties and Processing of Rigid Vinyls. C. E. Parks. SPE J. 7, 36-8 (Feb. 1951). The properties and processing of unplasticized vinyl chloride plastics are described. These materials are superior in heat, electrical, and chemical resistance and have higher mechanical strengths than the plasticized vinyl chloride plastics.

Properties of new Synthetic Rubbers and Plastics. G. B. Bachman, L. J. Filar, R. W. Finholt, L. V. Heisey, H. M. Hellman, L. L. Lewis, and D. D. Micucci. Ind. Eng. Chem. *43,* 997-1002 (Apr. 1951). The effect of different types of olefins on the physical properties of synthetic rubbers prepared by copolymerizing these olefins with butadiene was studied. Data are presented showing the variations in physical properties of a number of new synthetic rubbers. Both hot and cold tests were made. A large number of new copolymers of the thermoplastic type were prepared and physical properties studied. A new method of determining the refractive index of transparent solids was developed. A new property of plastics, the "sticking point," is defined, and a method proposed for measuring it is described.

Molding and Fabricating

Teflon-Molding and Extrusion. D. D. James. SPE J. *7,* 22-4 (Feb. 1951). The unusual techniques necessary for compression molding and extrusion of polytetrafluoroethylene parts are described.

Plastisol Molding. C. W. Patton. SPE J. 7, 24-6 (Feb. 1951). Techniques for molding parts from plastisols are described.

Modern Tool Design. Plastics (London) *16,* 36-7 (Feb. 1951). Thread design for a vacuum flask cup which eliminates the necessity for hand unscrewing to remove from the mold is described.

Plastics Can be Joined by Several Welding Methods. L. M. Jaroff. Materials & Methods *33,* 74-8 (Feb. 1951). Methods of welding thermoplastics are described in detail. These include hot gas, heated tool, high frequency, friction, flame, and radiant heat welding.

Applications

Acrylic Resins in Dentistry. Brit. Plastics *24,* 20-1 (Jan. 1951). The use of acrylic resins in dentistry is reviewed. Statistics on the volume used in Great Britain are reported.

New Insulating Materials and Coatings Extend Electric Motor Life. R. L. Custis. Materials & Methods *33,* 74-5 (Mar. 1951). Fiberglas-

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polyester tubing, and laminates and polyester varnishes are used in the construction of electrical motors. Their use improves resistance to corrosive atmospheres, high temperatures, oil, and dirt.

PHOTOELASTIC STRESS ANALYSIS USEFUL IN DESIGN OF METAL PARTS. M. M. Leven. Materials & Methods 33, 70-3 (Mar. 1951). Cast phenolic and polyester resins are used in photoelastic studies.

MOLDED ROTARY SEAL FACE MATERIAL. Brit. Plastics 24, 38-9 (Feb. 1951). The design and applications of rotary seals made of a phenolic plastic are described. This plastic contains powdered lead and other fillers to give a low coefficient of friction.

BONDING OF RUBBER TO METAL. C. J. Moss. Brit. Plastics 24, 22-6 (Jan. 1951). The bonding of rubber to metal is described. The results of experiments made with various rubber and resinous adhesives are reported.

Properties

INTERACTION BETWEEN CARBON BLACK AND POLYMER IN CURED ELASTOMERS. R. S. Stearns and B. L. Johnson. Ind. Eng. Chem. 43, 146-54 (Jan. 1951). This research was initiated to determine whether the interaction at the interface between the surface of finely divided solids, such as carbon black, and cured elastomers was primarily physical or chemical in nature. Further, it was desired to correlate some physical property of the reinforced stock with the surface properties of the solid pigment. Through an examination of the thermodynamic changes accompanying the deformation of loaded stocks it is shown that physical adsorption of the van der Waal's type occurring at the interface between pigment and polymer is inadequate to account for the experimental observations. However, if chemical bonding occurs at the interface between polymer and pigment, then the entropy of deformation of the stock may be correlated with the extent of this bonding. By a calorimetric method it was demonstrated that the surface of a carbon black particle contains sites that react with bromine to liberate the same amount of heat as low molecular weight olefins. Therefore, it is proposed that a carbon black particle be considered as a disordered agglomerate of polymeric benzenoid-type molecules which contain around their perimeters various functional groups. The existence of olefinic-type unsaturation on the surface of carbon blacks suggests strongly that, in the case of carbon blacks, the polymer and pigment are combined chemically through pigment - sulfur - polymer bonds into a continuous three-dimensional cross-linked matrix.

SPREADING OF LIQUIDS ON LOW ENERGY SURFACES. I. POLYTETRAFLUOROETHYLENE. H. W. Fox and W. A. Zisman. J. Colloid Sci. 5, 514-31 (Dec. 1950). Described are methods for preparing surfaces of polytetrafluoroethylene (TFE) which permit obtaining reproducible and reliable measurements of contact angles with liquids. Polytetrafluoroethylene is found to be an ideal low energy surface for the study of the wetting relations of a solid with a wide variety of organic and inorganic liquids. It is shown that all but the lowest boiling liquids studied do not adsorb on TFE sufficiently from the vapor to produce a significant spreading pressure. The observations show that there is a critical surface tension (17.5 to 20.5 dynes/cm.) below which liquids wet TFE. It is concluded that the corrected Young-Dupre relation coupled with the spreading coefficient permits a rational description of the results.

EFFECT OF STRUCTURE ON THE FIBER PROPERTIES OF LINEAR POLYMERS. I. ORIENTATION OF SIDE CHAINS. J. H. Brewster. J. Am. Chem. Soc. 73, 366-70 (Jan. 1951). The theory of the influence of the stereochemical orientation of side-chains on polymer properties is discussed. The polyurethans formed from 1,3-propanediol and 2,2-dimethyl-1,3-propanediol by reaction with hexamethylene diisocyanate are more crystalline than is that formed from 2-methyl-1,3-propanediol and the diisocyanate. The last named polymer possesses unpaired side-chains with random steric orientation. The polyamides of hexamethylenediamine and *meso*-, *d*- and *dl*-α,α'-dimethyladipic acid all form oriented fibers. All of these fibers are much weaker than is nylon; the polymer from the racemic acid is much the weakest of the three. All of the "dimethyl nylons" appear to suffer a slow reversion from the oriented state to the unoriented state. The "dimethyl nylons" undergo a secondary, rapidly reversible cold-drawing when subjected to stress greater than that required for primary cold-drawing. The fibers in this new state of orientation are opaque and lusterless; breakage of fibers always occurred in opaque, lusterless zones.

Testing

RESIDUAL MONOMER IN POLYSTYRENE. J. E. Newell. Anal. Chem. 23, 445-7 (Mar. 1951). A rapid method for the determination of monomeric styrene in polystyrene is described. Styrene absorbs ultra-violet radiation of wave lengths from 250 to 260 mμ., 40 to 100 times as intensely as polystyrene. Determination of small amounts of monomer in polymer, 0.1 to 2.0%, with precision and accuracy suitable for routine analysis, was accomplished by absorption spectrophotometry. The method is most accurate in the absence of impurities other than styrene monomer. The presence of significant amounts of interfering substances is made evident by poor agreement of calculations for monomer from absorption measurements at three wavelengths.

NATURAL AND SYNTHETIC RUBBERS. N. Bekkedahl. Analytical Chem. 23, 243-53 (Feb. 1951). Developments during the last two years in the analytical methods pertaining to natural and synthetic rubbers are reviewed. 219 references.

IMPACT-FATIGUE TEST FOR PAPER. R. S. Couch and T. J. Muldoon. Modern Packaging 24, 131-5, 180, 182 (Dec. 1950). An apparatus for dropping balls on sheet materials to give an impact-fatigue test is described. Results with paper and glassine packaging materials are reported.

Chemistry

POLYMERIZATION OF VINYL AND ALLYL ESTERS OF FATTY ACIDS. S. A. Harrison and D. H. Wheeler. J. Am. Chem. Soc. 73, 839-42 (Feb. 1951). This work was undertaken to determine why the vinyl and allyl esters of unsaturated fatty acids polymerize slowly and incompletely. It was found that the polymerization rate decreases as the degree of unsaturation in the fatty ester increases. The esters of the dienoic fatty acids polymerize very slowly and the degree of

(*Continued on p.* 125)

polymerization is low. It makes little difference in the polymerization rate whether the double bonds are conjugated or separated by a methylene group. The retardation of polymerization and low degree of polymerization are explained by the reaction of radical initiators and polymer chains with the unsaturation in the fatty acid molecule. These reactions give new radicals that react by radical combination, thereby either robbing the system of initiator radicals or terminating polymer chains.

Ion Exchange in Synthetic Resins. S. L. Gupta, M. Bose, and S. K. Mukherjee. J. Physical & Colloid Chem. 54, 1098-1109 (Nov. 1950). A resorcinol-formaldehyde cation-exchange resin and a *m*-phenylenediamine anion-exchange resin were used to investigate ion exchange in synthetic resins. The reaction between the acid resin and alkali was studied by adding known amounts of alkali and, after definite periods of time, analyzing the alkaline supernatant liquid. The exchange capacity thus obtained is determined by the following factors: the time of contact, the relative proportions of the solid and solution phases, the fineness of the resin, and the nature and concentration of the alkali. Baryta gives under identical conditions a higher value of the acidity or exchange capacity than sodium hydroxide. The presence of a high concentration of neutral salt increases the total neutralizable acidity. The amounts of cation adsorbed from either alkali or salts are much less than the exchange capacity obtained by way of estimation of the alkali consumed. A decrease in the time of heating during the process of curing the resin causes an appreciable reduction in exchange capacity. The symmetry values of the resin salts or the resinates of sodium and barium were determined against different cations. Chloride-ion concentration before and after the reaction of the added chlorides was the same, showing absence of molecular adsorption. The exchange of cations is equivalent and the cations show the lyotrope effect. The total exchange capacity of the anion-exchange resin is about one-fourth of the theoretical value, but shows a small lyotrope effect in its reaction with hydrochloric, sulfuric, oxalic, and phosphoric acids.

U. S. PLASTICS PATENTS

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each.

COPOLYMERS. D. T. Mowry and R. B. Seymour (to Monsanto). U.S. 2,544,393, Mar. 6. Copolymers of meta- and para-isopropenylbiphenyl.

POLYMERS. J. P. Jones and W. N. Axe (to Phillips Petroleum). U.S. 2,544,555, Mar. 6. Reaction of diolefin polymers with hydrogen and carbon monoxide

COPOLYMERS. J. R. Caldwell (to Eastman Kodak). U. S. 2,544,638, Mar. 13. Copolymers of acrylonitrile and N-allyl urea.

LAMINATES. M. T. Goebel and R. K. Iler (to Du Pont). U. S. 2,544,666-7-8, Mar. 13. Laminae of glass bonded with ethylenic aralkylol condensate polymer and pretreated with a Werner type complex.

ADHESIVE TAPE. J. H. Kugler and W. E. Lundquist (to Minnesota Mining). U. S. 2,544,692, Mar. 13. Adhesive for pressure-sensitive tape comprising a copolymer of isobutyl acrylate and 2-ethylbutyl fumarate.

ADHESIVE. E. E. Moore (to Stein, Hall). U. S. 2,544,714, Mar. 13. Adhesive comprising starch, urea resin, acid hardener, and an organic sulfonic acid salt.

FIBERS. B. Montero (to Modglin). U. S. 2,544,763, Mar. 13. Method of drawing plastic fibers.

CELLULOSE ESTERS. L. W. A. Meyer and W. M. Gearhart (to Eastman Kodak). U. S. 2,544,891, Mar. 13. Cellulose esters protected from ultra-violet light by p-methoxy phenyl p-anisate.

PHOTOSENSITIVE COATING. H. C. Staehle (to Eastman Kodak). U. S. 2,544,903, Mar. 13. Photosensitive coating of polymethyl acrylate containing water-insoluble azo dye.

POLYVINYL AZINE. T. G. Veal and G. P. Waugh (to Eastman Kodak). U. S. 2,544,906, Mar. 13. Polyvinyl azine coating for sound track.

CONDENSATES. F. C. Schaefer and D. H. H. Church (to American Cyanamid) U. S. 2,545,049, Mar. 13. Preparing condensates from aryloxytriazines.

POLYMERIZATION. A. D. Green and W. J. Paltz (to Standard Oil). U. S. 2,545,144, Mar. 13. Polymerization of iso-olefins in the presence of a Friedel-Crafts catalyst.

PHENOLIC RESINS. W. Krumbhaar. U. S. 2,545,150, Mar. 13. Rosin phenol-formaldehyde resin fused with a rosin maleic glyceride ester.

RESIN. G. R. Sido (to Monsanto). U. S. 2,545,174, Mar. 13. Ethers of aryl sulfonamide-formaldehyde condensates.

POLYMERS. R. R. Whetstone and T. W. Evans (to Shell Development). U. S. 2,545,182-3, Mar. 13. Production of polyallyl-type alcohols from polyallyl-type formates.

POLYMERS. L. N. Whitehill and E. C. Shokal (to Shell Development). U. S. 2,545,184, Mar. 13. Diallyl esters and polymers thereof.

LAMINATES. G. Kessler. U. S. 2,545,-286, Mar. 13. Inlaid laminates of wood impregnated with thermoplastic resin.

SHEET. S. Nixon. U. S. 2,545,300, Mar. 13. Extruding plastic material into a tank of liquid to form continuous sheet.

MOLDING POWDER. T. G. Clark (to U. S.). U. S. 2,545,446, Mar. 20. Cresylic-acid treated lignin and phenolic resin molding powder.

WOOL TREATMENT. J. N. Dalton and W. B. Kaupin (to Pacific Mills). U. S. 2,545,450, Mar. 20. Treating wool fabric with a methylol melamine.

VINYL RESIN. M. T. Harvey (to Harvel Research). U. S. 2,545,461, Mar. 20. Vinyl resin sulfurized furfuraldehyde reaction product.

COPOLYMERS. E. Lieber (to Standard Oil). U. S. 2,545,522, Mar. 20. Olefin-dihydronaphthalene copolymers.

PHENOLIC RESINS. C. F. Schrimpe (to Carbide and Carbon). U. S. 2,545,559, Mar. 20. Base-catalyzed phenolic resin modified with acetone resin.

POLYVINYL ACETAL. H. S. Bloch (to Universal Oil Products). U. S. 2,545,-683, Mar. 20. Polyvinyl acetal condensate combined with an N-substituted imine.

POLYMERS. H. Dannenberg and D. E. Adelson (to Shell). U. S. 2,545,-689, Mar. 20. Addition polymer of a 2-alkenyl dihydroxyalkanyl ether.

RESIN. C. E. Gleim (to Wingfoot). U. S. 2,545,692, Mar. 20. Forming a resinous reaction product of phenol, an aldehyde, and an amine in the presence of a polyhalophenol.

POLYSTYRENE. F. H. Norris (to Monsanto). U. S. 2,545,702, Mar. 20. Preparing stable polystyrene emulsions.

LAMINATES. B. D. Raffel (to Wingfoot). U. S. 2,545,704, Mar. 20. Metal foils laminated with a thermosetting adhesive.

SULFONAMIDE RESINS. R. B. Thompson (to Universal Oil Products). U. S. 2,545,716, Mar. 20. Resinous condensates of a sulfonamide with a monocarbonyl compound.

TUBING. S. J. Everett. U. S. 2,545,-729, Mar. 20. Apparatus for manufacturing thermoplastic tubing.

VINYL RESIN. S. J. Hetzel (to Sun Oil). U. S. 2,545,811, Mar. 20. 1,5-pentanediol esters of oxidized kerosene employed as plasticizers for vinyl resins.

LAMINATES. J. K. Wagers and E. C. Shokal (to Shell). U. S. 2,545,832, Mar. 20. Laminate of cellulose material bonded with a polymer of a diallyl ester of a dicarboxylic acid.

FENCE PICKET. N. J. DuBarro and C. Wolf. U. S. 2,545,845, Mar. 20. Plastic fence picket.

FILMS AND FILAMENTS. J. Bailey (to Plax). U. S. 2,545,868-9, Mar. 20. Apparatus for forming films and fibers of oriented plastic material.

SHEET. H. Warp (to Flex-O-Glass). U. S. 2,545,981, Mar. 20. Beaded plastic sheet.

RESIN. W. J. Sparks and J. D. Gar-

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ber (to Standard Oil). U. S. 2,546,020, Mar. 20. Hard resinous copolymer of butadiene and diisobutylene.

PACKAGING. W. S. Cloud. U. S. 2,546,059, Mar. 20. Method and apparatus for packaging articles in plastic sheet material.

WELDING. N. S. Norris. U. S. 2,546,-164, Mar. 27. Electrical apparatus for welding thermoplastic material.

POLYMERIZATION. D. Bandel (to Mathieson Chemical). U. S. 2,546,207, Mar. 27. Including a salt of a copolymer of dichlorostyrene and methacrylic acid to prevent agglomeration during emulsion polymerizations.

SEALING. M. M. Barton (to Injection Molding). U. S. 2,546,208, Mar. 27. Sealing a closure on a thermoplastic container with heat and pressure.

POLYMERIZATION. C. F. Fryling and W. B. Reynolds (to Phillips Petroleum). U. S. 2,546,220, Mar. 27. Emulsion polymerization with a catalyst comprising a diazo thioether and a ferricyanide.

CORRUGATED SHEET. P. Modigliani (to Johns-Manville). U. S. 2,546,230, Mar. 27. Method of forming corrugated glass-fiber-mat polyester sheet.

POLYMERIZATION. J. C. Richards (to Du Pont). U. S. 2,546,238, Mar. 27. Terminating polymerization of acrylonitrile by adjusting pH to 6.0 to 10.0.

POLYMERIZATION. C. M. Tucker (to Phillips Petroleum). U. S. 2,546,244, Mar. 27. Incremental addition of alkaline material during emulsion polymerization.

SHEET. P. A. Talet (To Societe Nobel Francaise). U. S. 2,546,618, Mar. 27. Impregnating fibrous sheet with polyvinyl alcohol, drying, and immersing in a solution of formaldehyde and sulfuric acid to convert to the formal.

PERMEABLE MATERIALS. R. S. Adams (to Halliburton Oil Well Cementing). U. S. 2,546,624, Mar. 27. Filter for oil well use comprising clay and phenolic resin.

LAMINATE. J. F. Stawinski. U. S. 2,546,705, Mar. 27. Stretching polyvinyl alcohol film, applying thin paper webs thereto, and restraining during drying.

COPOLYMERS. P. O. Tawney (to U. S. Rubber). U. S. 2,546,798, Mar. 27. Soluble copolymers of allylic maleates with allylic alcohols.

RESIN ESTERS. W. Krumbhaar. U. S. 2,546,826, Mar. 27. Depolymerized-rosin-acid polyhydric-alcohol ester modified with phenol-formaldehyde resin.

AMINE-ALDEHYDE RESIN. H. P. Wohnsiedler and W. S. Sloatman, Jr. (to American Cyanamid). U. S. 2,546,841, Mar. 27. Amine-aldehyde resin plasticized with a polyvinyl acetal and o-cresyl glyceryl ether.

POLYMERIZATION. W. Freudenberg (to General Aniline). U. S. 2,546,924, Mar. 27. Polymerization of N-vinylpyrrole compounds.

POLYMERIZATION. H. J. Passino (to M. W. Kellogg). U. S. 2,546,930, Mar. 27. Polymerizing olefins in the presence of a double fluoride catalyst.

ION EXCHANGE. W. C. Banman and G. B. Heusted (to Dow). U. S. 2,546,938, Mar. 27. Ion exchange phenol-alkylene polyamine resins.

PHENOLIC RESINS. H. D. Hartough and J. W. Schick (to Socony-Vac-

uum). U. S. 2,546,946, Mar. 27. Phenolic resin containing nitrogen introduced by ammonium halide.

EXTRUSION. F. J. Churnell and K. E. Smith (to Federal Telephone). U. S. 2,546,975, Apr. 3. Device for extruding plastic jacket about a core.

EXTRUSION. A. N. Gray (to Western Electric). U. S. 2,547,000, Apr. 3. Apparatus for simultaneously advancing and plasticizing plastic material.

POLYMERIZATION. J. D. Kemp and L. F. Brooke (to Calif. Research). U. S. 2,547,013, Apr. 3. Reduction of phosphoric acid corrosion in polymerizations wherein olefins are contacted with the acid.

RESINS. J. G. N. Drewitt and G. F. Harding (to Celanese). U. S. 2,547,-113, Apr. 3. Production of poly-ester-amides.

PONTOON. H. E. Anthony. U. S. 2,-547,146, Apr. 3. Forming fibrous sheets impregnated with a plastic to form a pontoon and curing.

EXTRUSION. A. H. Braeseke. U. S. 2,547,151, Apr. 3. Extrusion machine.

DISPENSER. C. A. Strohmeier (to A. J. Rose and N. Rose). U. S. 2,547,179, Apr. 3. Gun for dispensing plastic material.

HYDROGENATED POLYMERS. C. B. Linn (to Universal Oil Products). U. S. 2,547,274, Apr. 3. Improving drying properties of copolymers of cyclic polyolefins by partial hydrogenation.

IMIDO ESTERS. S. P. Rowland (to Rohm and Haas). U. S. 2,547,498, Apr. 3. Polymeric imido esters prepared from maleic adducts of fatty acid esters and bis-azolines.

PLASTIC. R. J. Signer and K. F. Beal (to Visking). U. S. 2,547,605, Apr. 3. Formed structures of mixtures of polychloroprene, vinylidene chloride-acrylonitrile copolymer, and butadiene acrylonitrile copolymer.

VINYL COPOLYMERS. J. Bisch and X. Thiesse (to Compagnie de Produits Chimiques et Electrometallurgiques). U. S. 2,547,618, Apr. 3. Manufacture of functional derivatives of polyvinyl copolymers.

RESINS. F. J. Foster (to U. S. Rubber). U. S. 2,547,696, Apr. 3. Soluble fusible unsaturated halogen-containing resins made by polymerization of mixture composed of di-2-alkenyl fumarate and bromotrichloromethane.

RESINS. R. A. Gregg (to U. S. Rubber). U. S. 2,547,701, Apr. 3. Polymerization of di-2-alkenyl ester of an α-ethylenic dicarboxylic acid in the presence of bromotrichloromethane.

SHEET. E. H. Land and W. H. Ryan (to Polaroid). U. S. 2,547,763, Apr. 3. Method of stretching continuous plastic sheet.

COPOLYMERS. W. L. J. de Nie (to Shell Development). U. S. 2,547,815, Apr. 3. Copolymerization of vinylidene halides with ethylenically unsaturated compounds.

INTERPOLYMERS. F. Grosser (to General Aniline). U. S. 2,547,819, Apr. 3. Vinyl ether and tri- or tetrachloroethylene interpolymers.

PACKAGING. F. B. Pfeiffer. U. S. 2,547,835-6, Apr. 3. Method and apparatus for continuously packaging materials in plastic film material.

SHEET MATERIAL. L. S. Meyer and E. K. Ritterhoff. U. S. 2,547,880, Apr. 3. Method and apparatus for corrugating sheet materials and forming laminated cellular units thereof.

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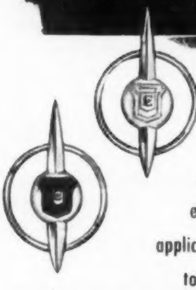

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BOOKS AND BOOKLETS

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"Plasticizers" by D. N. Buttrey.

Published in 1950 by Interscience Publishers Inc., 250 Fifth Ave., New York 1, N.Y. 175 pages. Price $3.50

Properties, salient features, and applications of plasticizers, grouped according to chemical type, comprise the bulk of this book. In filling what the author and publisher felt was a gap in plastics literature, emphasis has been placed on those plasticizers which have already found commercial application, or which show promise of future importance. As a result, the number considered here has been limited to about 400. The last chapter, a brief survey of theories on plasticizer functions, has been written as something of an addendum with a view toward being of value to the technician not closely familiar with the subject.

"The Condensed Chemical Dictionary" Francis M. Turner, editorial director.

Published in 1950 by Reinhold Publishing Co., 330 W. 42nd St., New York, N. Y. 726 pages. Price $10.00.

Completely revised, this fourth edition has been brought up to date and enlarged. The addition of 5000 new entries brings the total to over 23,000 items. Included are data on the chemical and physical properties of chemicals and raw materials, and information on containers, shipping regulations, and safety instructions. Many of the new entries in such fields as nuclear chemistry, chemotherapy, and petrochemistry, cover products and processes which may, as yet, have no industrial applications but which are of definite scientific importance.

"ASTM Manual on Quality Control of Materials"

Published in 1951 by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 100 pages. Price $1.75.

Sponsored by Committee E-11 on Quality Control of Materials, this publication is designed to replace the old Manual on Presentation of Data. The first section of the book covers the presentation of data and discusses the application of statistical methods; the second part presents limits indicating the uncertainty of the average of a sample of observations; the third section presents formulas, tables, and examples useful in applying the control chart method of analysis and presentation of data.

"Ion Exchange Resins" by Robert Kunin and Robert J. Myers

Published in 1950 by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 212 pages. Price $4.75.

Existing data on various phases of the ion exchange phenomenon are organized and clarified in this reference book. Topics considered are the theory underlying the ion exchange mechanism, the usefulness of the resins, operational and engineering data, and laboratory and industrial methods for using the resins in the power, chemical process, agricultural, medical, pharmaceutical, and sanitation fields. In addition to historical and theoretical discussion, the book contains chapters on the recovery of metals, sugar refining, water softening, and other applications. Characteristics of commercial resins are tabulated; the design and operation of ion exchange apparatus is described.

"Materials of Construction for Chemical Process Industries" by James A. Lee

Published in 1951 by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. 468 pages. Price $6.50.

Solutions to corrosion problems found in the production, handling, and packaging of foodstuffs, and in process industries such as sulphate paper, soap, synthetic resins, and cane sugar, are discussed on the basis of actual plant experience. Three hundred chemicals and foodstuffs are covered, with a description of the process involved in each case, a discussion of the corrosiveness of the chemical when it is being used as a finished product or as a raw material, and an analysis of the materials of construction that are used for shipping containers.

Nitrocellulose cements—Package stability and ease of handling of nitrocellulose cements are discussed in this four-page folder. A chart compares three formulations as to grade, type of base, drying speed, total solids, and weight per gallon. To assure that gelling will not occur, each batch of cement is given an accelerated lead-paste gel test before shipment. *Merrimac Div., Monsanto Chemical Co., Everett, Mass.*

Aging characteristics of electrical insulation—Details of a new procedure of determining the aging characteristics of electrical insulation are now available in this 13-page report. Developed at the Naval Research Laboratory, the procedure uses coils wound and subjected to stress such as are experienced by motor windings to duplicate physical factors which influence the aging of insulation. This report, including photographs, designs, graphs and tables, is available for 50¢ from *Office of Technical Services, U. S. Dept. of Commerce, Washington 25, D. C.*

Lumarith acetate transparent film for packaging and other purposes—Designed as a guide for converters, manufacturers, product engineers, and designers, this 16-page booklet contains detailed information on types and formulations, mechanical and physical properties, and package applications of Lumarith film. *Plastics Div., Celanese Corp. of America, 180 Madison Ave., New York 16, N. Y.*

Continuous automatic processing equipment—Some of the more advanced machine design elements involved in continuous coating equipment for such web materials as textiles, papers, films, and foils, and such strand materials as wires, cables, and synthetic monofilaments are covered in this 16-page booklet. Units for web coating discussed in detail include roller coaters, unwind stands, and cooling drums. Also discussed are the component units for both dip and extrusion coating systems of strand materials—letoffs, dip-coating pot arrangements, ex-

(*Continued on p.* 136)

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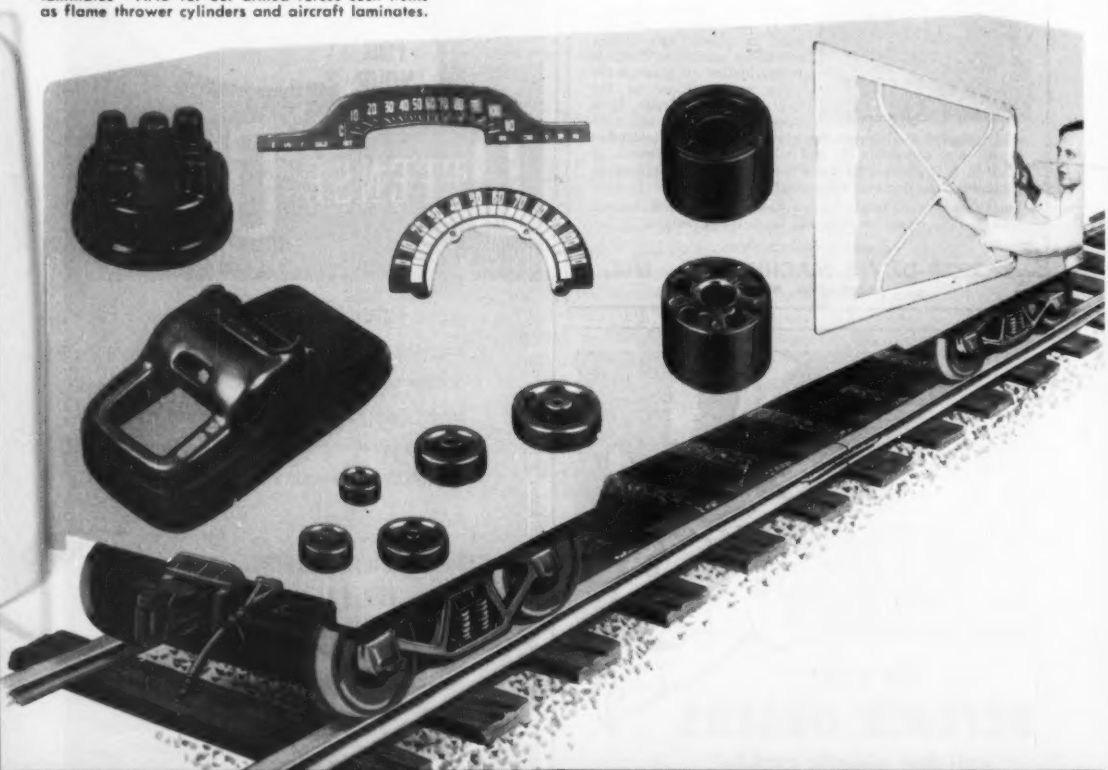

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trusion machines, propelling stands, constant tensioning stands, and winding machines. *Industrial Ovens, Inc., 13825 Triskett Rd., Cleveland 11, Ohio.*

Price list of American standards—This latest, revised, 26-page edition contains more than 1180 standard specifications, methods of test, and symbols and abbreviations for a wide variety of industries. New standards listed include a series of electric discharge lamps; electrical indicating instruments; gas water heaters; grounding-type attachment plug caps and receptacles; and safety requirements for operation of open-surface tanks. *American Standards Association, 70 E. 45th St., New York 17, N. Y.*

Chemigum rubbers—Properties and compounding details for Chemigum, a nitrile synthetic rubber, are presented in this 30-page booklet. Some suggested applications, for which formulations are given, include gasoline hose or fuel cell interliners; oil-resistant shoe soles and automotive parts; hard packing compound; high and low grade molding compounds; abrasion-resistant belt covers; and friction, extrusion, hard rubber, and hard gasket compounds. Use of the material in general and pressure adhesives is also covered. *Chemical Div., The Goodyear Tire & Rubber Co., Inc., Akron 16, Ohio.*

Plastic cylinder fabricators—Two machines which are used together in making beaded cylinders for transparent packages—Model 135 Cylinder End Beader and Model 138 Cylinder Maker—are fully described in this six-page folder. Specifications given for each model include capacity, production rate, size, weight, and parts and supplies. *Taber Instrument Corp., 136 Goundry St., N. Tonawanda, N. Y.*

Valve catalog—The firm's complete line of valves is listed in this 44-page booklet. Hundreds of standard models and modifications are described, including straightway, three-way, four-way, and four-way five-port units in various sizes of hand, foot, solenoid, pilot, remote control, cam, speed control, quick exhaust, and miscellaneous valves. Detailed descriptions are given together with sectional views, installation data, and diagrams. In addition, one section is devoted to general reference data such as a non-technical explanation of air valve operation and the manner in which various types differ. *Ross Operating Valve Co., 120 E. Golden Gate, Detroit 3, Mich.*

Dimer acid—Establishment of 955 Dimer Acid as a standard sales product has been announced in conjunction with release of a 16-page booklet describing the product. The material is a liquid, dibasic acid with good heat stability and low volatility. Outlined in the booklet are characteristics, specifications, shipping and handling data, and potential applications in soaps, greases, esters, polyamide resins, ester-amides, hot tin dipping, insecticides, and emulsion breakers. Data pertaining to its utilization in bodied oils, varnishes, and alkyd resins are also included. *Emery Industries, Inc., Dept. 5, Carew Tower, Cincinnati 2, Ohio.*

Plastic-surfaced plywood—Issued as a reference source for dealers, architects, engineers, and industrial designers, this four-page folder describes the types of plastic-surfaced fir plywood, properties of the overlay panels, and some of the many applications in building and industry. Also included are recommendations for use of the new premium-surface panel material which combines the desirable properties of fir plywood and plastics. *Douglas Fir Plywood Association, Tacoma Building, Tacoma 2, Wash.*

Rotary work feed table (Bull. T-80)—Detailed information and specification data on all parts of the rotary feed table are contained in this 12-page bulletin which includes installation photographs and dimensional drawings. Wiring diagrams and electrical hook-ups show how to combine the rotary feed table with other "packaged" pneumatic devices offered by the company. *The Bellows Co., 222 W. Market St., Akron, Ohio.*

Surface coatings—Protective and decorative coatings for all types of surfaces are described in this profusely illustrated 28-page booklet. Case histories are presented which range from tiny metal closures to huge railroad hoppers and oil tanks, all protected with Vinylite resin-based coatings against such destructive forces as weather, abrasion, moisture, chemical attack, and rust. The booklet describes the variety of surfaces which can be coated, including metal, paper, cloth, masonry, brick, concrete, and wood, and discusses the various techniques of application such as spraying, brushing, roller and knife coating, and dip coatings. *Bakelite Co., Div. Union Carbide and Carbon Corp., Dept. 1503, 300 Madison Ave., New York 17, N. Y.*

Consulting Services—This 13th edition of a compilation of chemical consultants who serve every type of business is set up in three sections: Section I contains professional, business, and industrial headings under which a problem may be classified; Section II describes the qualifications and activities of the members of the association; Section III is an index listing the members and their organizations both alphabetically and by geographical location. *Association of Consulting Chemists and Chemical Engineers, Inc., 50 E. 41st St., New York 17, N. Y.*

Ion exchange patents—The first list of synthetic resin patents ever compiled according to the use of the product is given in this 24-page booklet. Containing 166 patents, for which the main technical claims are given, the synthetic resin patents with miscellaneous applications in ion exchange processes date from 1934 through 1950. Exact expiration dates of all patents are shown. The booklet is available for $5 from *Patent Publications, Box 4094, Washington 15, D. C.*

Processing equipment—This miniature 70-page bulletin sets forth the complete line of custom-made machinery now offered by this firm. Equipment includes jaw and rotary crushers, crushing rolls, hammer mills, ring roll and rock emery mills, laboratory machines, vibrating screens, air separators, batch blenders, and elevators. *Sturtevant Mill Co., Harrison Square, Boston 22, Mass.*

Acetate color chart—Displayed on a 9- by 12-in. board are samples of colors and finishes of metallic and coated acetate available from this company. The chart features 17

(*Continued on p.* 139)

metallic translucent colors; 10 chalk colors of opaque coated acetate; 15 transparent tints on clear cellulose acetate; 4 chalk iridescent types; and 4 transparent iridescent types. Materials illustrated are made in gages ranging from 3 to 20. Suggested applications include advertising novelties and signs; counter displays; packaging; toys; lamp shades; silk screening; mirrors; compacts; labels; wrapping paper; greeting cards; and decorative window displays. *Coating Products, 136 W. 21st St., New York 11, N. Y.*

G-E thermosetting molding powders—Complete information on the company's plastics molding powders, which conform to the latest United States Military Specification MIL-P-14A, is listed in this 34-page booklet. Designed as a convenient pocket reference, the literature describes a wide variety of grades and gives powder and molded properties. *General Electric Co., Pittsfield, Mass.*

Plastics specification guide—An 8½ by 11-in. folder of tables correlates all systems of grade specifications drawn up by industry and various Government agencies for laminated plastic sheets, tubes and rods. For tubes and rod stock, specifications include Synthane, NEMA, Military specification, Military type, Navy 17-P-5 type, JAN-P-79 (Type LTS), and A.S.T.M. designations for eight grades of rolled tubes, 10 grades of molded tubes, and 10 of molded rods. Grade designations of sheet materials cover: Synthane, Military specifications, Military specification type, JAN-P-13 (Type LTS), Navy 17-P-5 type, Army 71-484 type, A.S.T.M. type, and Federal specification HH-P-256 by both type and grade coding. *Synthane Corp., Oaks, Pa.*

Boltaron — Information about the company's high-impact, low-pressure molding material is presented in this four-page folder. The material is claimed to be tough, chemical-resistant, and water-, stain-, and grease-proof. Some of its applications are fender guards; cases for typewriters, silverware, and luggage; trays; formed desk tops; letters for outdoor advertising; ice cream and deep freeze lids; dash panels; and sun visors. *Bolta Products Sales, Inc., 151 Canal St., Lawrence, Mass.*

NEW MACHINERY AND EQUIPMENT

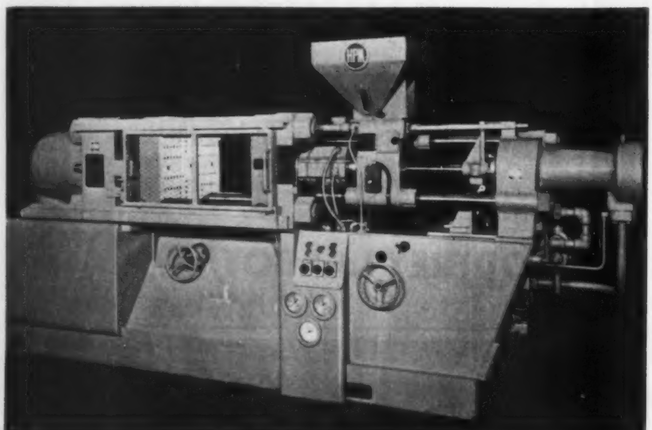
GRANULATOR—Model 10 granulator, developed by Cumberland Engineering Co., Inc., Dept. 1N, Box 216, Providence, R.I., has been designed for use beside injection molding machines. Principal feature is a larger throat opening, 6 by 10 in., permitting the granulation of larger, more bulky parts than was previously possible. Large sprues and runners produced by the injection machine can be immediately fed into the Model 10 and granulated on the spot, thus saving the labor of central grinding. The grinder is powered by a 3-hp. 1800-rpm. motor in the base.

NINE-OZ. MOLDER—Many new features have been incorporated in a new 9-oz. injection molding machine, the H-P-M "9", designed by The Hydraulic Press Mfg. Co., Mount Gilead, Ohio. In a production test, the machine cut rejects to less than 1 percent.

Among the improvements in the H-P-M "9" is the hydraulic system which, in response to requests by molders, is out in the open for ease of maintenance. The press can be double stroked for stuffing 40 to 50% more material into the injection chamber for larger shots. Mold clamp is hydraulically actuated by a large area ram with a small internal booster ram for fast closing. Three adjustable automatic slow-downs—just prior to mold contact, during mold breakaway, and while injecting—protect mold and molded parts from damage.

Other highlights include maximum mold space, 17¼ by 26 in.; daylight opening, 27 in.; mold clamp stroke, 18 in.; and plasticizing capacity, 60 lb. per hour. The plasticizing chamber is equipped with a two-zone heating system; and the entire unit is provided with two H-P-M radial piston-type, variable delivery pumps.

Double stroking device on new 9-oz. injection molding machine increases stuffing capacity



STRIP CHART RECORDER—Up to six permanent records on one chart can be provided by a new strip chart recorder, the Multipoint Capacilog, developed by Wheelco Instruments Co., 847 W. Harrison St., Chicago 7, Ill. Measurements can be obtained with such sensing units as thermocouples and radiation detectors producing electrical signals.

The deflection-type system on which the Capacilog operates is a direct-reading, non-balancing method for detecting changes in a measuring circuit. Each recorded point is clearly printed on the chart with a number and diamond for each of from one to six variables. Thus, continuous curves form from the impressions.

An important feature is the Electronic Link whereby a small aluminum vane is attached to the measuring pointer. The pointer, independent of batteries or electrical balancing circuits, is free to follow the changes of the measured variable. While the pointer moves between two sensing coils through which an oscillating current flows, the vane, moving within the electronic field, guides a follow-up action through a drive motor. This motion is synchronized with a simple chart-printing device.

DUST CAPS FOR TABLETTING MACHINES—Neoprene dust caps for use on rotary tabletting equipment are being produced by F. J. Stokes Machine Co., 5900 Tabor Rd., Philadelphia 20, Pa. Primary functions of these cups—which are attached to the upper punch of the tabletter—are to catch running oil or grease on the punch shank and keep it from falling into the granulation and to prevent dust from puffing up from the point of compression and gathering on the lower shank or keyway where it would dry the lubricant on the shank.

To install the cups, holes are punched in their centers by placing them over a die and rotating the machine by hand. Through their use, maintenance is reduced and lubrication is required at less frequent intervals. The oil- and grease-resistant neoprene cups require cleaning only once or twice a week.

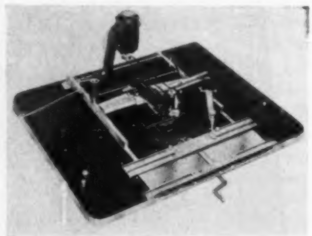
ELECTRIC LABEL DISPENSER—Mechanization of hand-labeling operations is made possible by the new E-350 electric label dispenser developed by Avery Adhesive Label Corp., Monrovia, Calif., for its Kum-Kleen Self-Adhesive Labels. The automatic device, claimed to increase labeling speed in some cases by 500%, is said to eliminate moistening, heat, sorting of loose labels, and the messiness of excess glue.

A span of accurate speeds ranges from 10 to 150 lineal inches per minute. The machine can be stopped and started with split-second precision. Foot switch controls are pro-

vided when intermittent operation is desired; in such cases, a predetermined speed rate (controlled by a rheostat) resumes automatically.

Model E-350 can handle labels from $\frac{1}{2}$ to 3 in. wide, and from $\frac{1}{8}$ to 6 in. long. It is designed as a compact, portable unit which fits into any production line.

ENGRAVER—Latest addition to the line of engravers produced by New Hermes, Inc., 13-19 University Place, New York 3, N. Y., is an enlarged capacity portable unit capable of engraving metal or plastics up to 25 in. in width and in any length. The machine is said to be particularly suitable for engraving names, numbers, and instructions on dials, name



plates and panels. It can also be converted into a tracer-guided electric etcher for identifying tools and dies.

Designated the Engravograph, the equipment works on the pantograph principle. It is available in both portable and heavy-duty models. The unit can engrave 15 different sizes from one alphabet template, and can perform multiline engraving in one setup using adjustable copy holders.

REDUCING VALVE—Use of Stellite facing for the main valve and seat ring provides greater durability in an improved high pressure reducing valve, No. 197-135 Type "E" made by Atlas Valve Co., 282 South St., Newark 5, N.J. Valves gain greater resistance to abrasion and corrosion from the Stellite facings. Stellite possesses great hardness, and has a strength of 100,000 p.s.i. at ordinary temperatures and over 65,000 p.s.i. at 1500° F.

Packings in the Type "E" valve are made particularly for high pressure service. Pressure on the seat is balanced by a piston above. The valve handles water, oil, or air, and functions without shock.

INTERNATIONAL PLASTICS NEWS*

Activities Around the World of Interest and Importance to the Plastics Industry in the United States

Britain making polystyrene—Large-scale commercial production of polystyrene powder, sheet, and rods is officially announced by Styrene Products Ltd., Partington, near Manchester, England. Styrene Products Ltd. was formed jointly by Petrochemicals Ltd. and Erinoid Ltd. The new plant, designed and constructed by Petrocarbon Ltd., is the second one to come into operation in a year in England (see MODERN PLASTICS, Sept. 1950, p. 146), and currently has an output of about 3000 tons a year or about half of its potential capacity. Capacity will be fully utilized when the adjacent monomer plant of Petrochemicals Ltd. starts production which will probably be within the next year. Then, monomer will be pumped across the road for polymerization by Styrene Products Ltd.

It is thought that this close physical link between monomer and polymer plants will be unique in large-scale plastics operations. At present, however, production at Styrene Products is based on imported monomer and, while the output is an important addition to domestic supply sources (which until recently had to rely on imported powder, with a guarantee of 90% for re-export by converters), the full benefit for home and export sales will not be felt until the capacity output is achieved.

Some 90% of the present output is in powder form, and four-fifths of that output is of colored powder. A full range of colors is available, all of them reported to be bright, clear, and resistant to heat and light.

Early applications of the material by British users include radio set cabinets, two-color all-polystyrene ukeleles, razor packs, cosmetic packs, hair curlers, and flashlight lenses.

The entire output of material from the Styrene Products plant is being marketed by Erinoid Ltd., Stroud, Gloucester, England.

British melamine factory—The melamine resin plant being erected at Chester-le-Street by The British Oxygen Co., Ltd., London, is likely to be in production late this year. In the meantime, British Oxygen is operating a small pilot plant so that bulk samples can be provided for use in development work between now and the opening of the new factory. The pilot plant has been in operation for about 18 months at a production rate of some 100 tons a year.

The new plant will produce melamine resins for use in molding powders, adhesives, laminates, paints, and paper and textile treatment. Technical bulletins outlining the properties of melamine are available from Chemicals Div., The British Oxygen Co., Ltd., Bridgewater House, Cleveland Row, St. James's, London, S.W.1.

American designs in Milan—An exhibit of current American designs is being shown at the Nona Triennale di Milano, Milan, Italy. The exhibit, consisting of about 70 photographs of recently designed American products, was prepared specially for the famous Milan exposition by the Society of Industrial Designers, New York, N.Y. The exposition, which opened on May 5, will last until September 13.

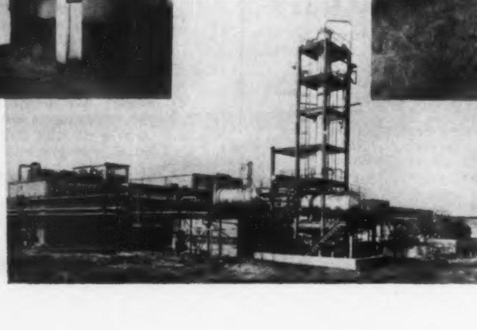
Plastics educational kit—The Plastics Research Institute T.N.O., Delft, Holland, has prepared a number of kits for the Ministry of Education, Arts, and Sciences for distribution to secondary schools in Holland. The kits are designed to instruct students on plastics.

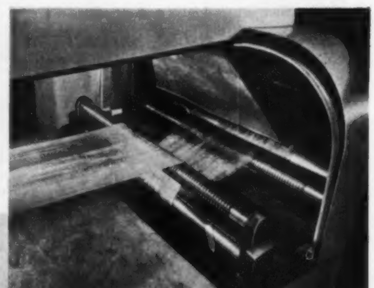
The kits are packed in white var-

* Reg. U. S. Pat. Office.

Above: Section of the reactor room of new polystyrene plant. Buildings cover area of 4½ acres and are equipped with special dust-extracting device

Below: New polystyrene plant is located next to unit making petroleum chemicals. In foreground is preliminary treatment plant which removes inhibitors and impurities from monomeric styrene material





Above: Close-up of straightening rollers in extruding section of polystyrene plant. The continuous sheet is later reduced to molding powder

nished wooden boxes, and each contains seven small bottles of molding powder samples; 54 samples of plastics products manufactured by various techniques; and 18 diagrams showing the manufacture of various plastics materials.

Samples used to make up the kits were contributed free of charge by the Netherlands plastics industries, and the necessary funds to make up the kits were procured by the Federation of Netherlands Plastics Manufacturers.

Vinyl-coated oil container—Because of metals shortages, a French package manufacturer, Tecalemit, S.A., Paris, has developed cardboard containers to hold motor oil and other petroleum products. Greaseproof qualities are imparted by coating the inside of the container with Geon polyblend latex, a vinyl resin plasticized with Hycar nitrile rubber.

Machine Tool Exhibition—The 1st European Machine Tool Exhibition will be held in Paris, Sept. 1 to 10. The principal Belgian, French, German, Italian, and Swiss mechanical achievements will be shown along with a number of American, British, Austrian, Danish, Dutch, and Swedish machines. Information about the exhibition can be obtained from 1st European Machine Tool Exhibition, 2 bis rue de la Baume, Paris 8^e, France.

Plastics meetings in India—An All India Plastics Exhibition was held recently in Bombay under the auspices of The All India Plastics Manufacturers' Association. The purpose of this Exhibition was to educate the public about plastics. Eighteen firms participated, including molders, extruders, fabricators, die makers, and raw material suppliers.

The Fourth All India Plastics Manufacturers' Conference was also held in Bombay on April 28 and 29. New officers of the manufacturers' association were elected at the conclusion of the conference. The new officers are: president, B. A. Shah, Collins & Co., Bombay; vice-presidents, B. L. Pachisia, Plastics Moulders, Ltd., Calcutta, and P. U. Mehta, National Engineering & Electroplating Works, Bombay; secretaries, R. N. Desai, Oriental Plastics Corp., Bombay, and B. P. Himmatsingka, Bharat Plastics, Ltd., Calcutta.

The Lockheed F-94 Jet Fighter is equipped with ZENALOY* parts by ZENITH

This great Lockheed fighter-interceptor possesses the capability of tracking and destroying fast high-flying enemy bombers during both daylight and darkness and under all weather conditions.

ZENITH takes special pride in the fact that ZENALOY* parts have contributed their strength to this vital addition to our country's defense and will be glad to have the aircraft industry consult its Engineering Division for other applications of this versatile material.

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ZENITH PLASTICS COMPANY • Gardena, California

Production of

FOR the purpose of this report, production is the sum of the quantities of materials produced for consumption in the producing plant for transfer to other plants

PLASTICS AND SYNTHETIC RESIN PRODUCTION
From Statistics Compiled

Materials	*Total p'd'n. first 3 mos. 1951*	*Total sales first 3 mos. 1951*
CELLULOSE PLASTICS:[*]		
Cellulose acetate and mixed ester plastics:		
Sheets, under 0.003 gage	3,894,612	3,831,114
0.003 gage and over	3,165,609	3,191,122
All other sheets, rods, and tubes	1,668,802	1,587,165
Molding, extrusion materials	19,221,345	18,066,105
Nitrocellulose:		
Sheets	1,880,053	1,700,152
Rods and tubes	324,376	359,192
Other cellulose plastics[b]	3,642,395	3,565,909
PHENOLIC AND OTHER TAR ACID RESINS:		
Laminating	21,729,282	15,095,767
Adhesives	11,400,566	10,212,280
Molding and casting materials[a]	60,994,841	54,055,287
Protective coatings (unmodified and modified except by rosin)	6,261,131	4,623,715
Miscellaneous uses	19,043,594	18,766,792
UREA AND MELAMINE RESINS:		
Adhesives	25,192,925	24,028,449
Textile-treating resins	7,368,583	6,776,574
Paper-treating resins	3,914,075	3,629,341
Protective coatings, modified and unmodified	8,820,319	6,661,000
Miscellaneous uses, including laminating and molding[c]	22,216,465	19,765,033
STYRENE RESINS:		
Molding materials[a]	57,233,934	55,763,763
Protective coatings, modified and unmodified	9,889,392	10,253,985
Miscellaneous uses	14,238,401	13,390,169
VINYL RESINS:[d] Total	105,400,756†	102,488,088
Sheeting and film (resin content)[e]		43,889,607
Adhesives (resin content)		2,553,334
Textile and paper-treating resins (resin content)[f]		11,006,836
Molding and extrusion materials (resin content)		32,603,013
Protective coatings (resin content)		7,975,319
Miscellaneous uses (resin content)		4,419,979
COUMARONE-INDENE AND PETROLEUM POLYMER RESINS:	43,079,954	42,756,135
MISCELLANEOUS SYNTHETIC PLASTICS AND RESIN MATERIALS:		
Molding materials[a, g]	19,251,920	17,384,889
Protective coatings[h]	4,652,075	5,241,155
All other uses[i]	27,854,765	26,654,971

[*] Dry basis unless otherwise specified. † Revised. [a] Includes fillers, plasticizers, and extenders. [b] Includes sheets, rods, and tubes, and molding and extrusion materials. [c] Data on resins for laminating and miscellaneous uses are on a dry basis; data on molding materials are on the basis of total weight. [d] Production statistics by uses are not representative as end-use may not be known at the time of manufacture. Therefore, only statistics on

Plastics Materials

of the same company, and for sale. Sales include only the quantities involved in bona fide sales in which title passes to the purchaser.

IN POUNDS[e] FOR FEBRUARY AND MARCH, 1951
by U. S. Tariff Commission

February 1951		March 1951	
Production	*Sales*	*Production*	*Sales*
1,164,854	1,100,489	1,271,004	1,252,865
952,126	958,533	1,048,484	1,032,778
471,756	486,141	666,622	483,155
5,801,627	5,713,092	6,214,704	6,101,132
557,208	486,162	679,652	569,065
110,324	107,132	127,012	117,191
1,056,223	1,145,770	1,252,083	1,208,381
6,196,593	4,336,179†	8,019,285	5,150,720
3,627,052	3,271,049	4,093,827	3,761,353
17,658,648	15,887,765	21,309,779	18,843,922
1,809,196	1,457,968	2,171,222	1,560,281
5,059,200	4,963,284	6,356,027	6,476,563
7,087,326	7,194,041†	9,149,386	8,947,618
2,461,468	2,444,467	2,254,968	2,128,175
1,199,272	1,160,990	1,632,466	1,468,291
2,885,872	2,203,003	3,151,173	2,339,084
6,612,207	6,314,614	8,423,389	8,007,064
17,179,234	17,162,960	20,570,222	20,213,805
2,667,640	3,393,102	3,322,502	3,154,194
4,537,415	4,387,180	4,591,975	4,399,930
31,812,513†	30,602,985	39,187,952	37,039,406
	12,978,306		15,359,196
	817,652		791,580
	3,259,654		3,959,010
	9,916,015		11,553,729
	2,384,025		3,467,036
	1,247,333		1,908,855
13,038,354	12,535,424	15,758,236	15,796,335
5,914,401	4,461,909	6,644,328	6,225,077
1,475,107	1,785,374	1,667,374	1,774,853
8,349,409	7,928,392	9,903,518	9,266,792

total production are given. [e] Prior to January 1951, statistics were given on the basis of total weight. [f] Includes data for spreader and calendering-type resins. [g] Includes data for acrylic, polyethylene, nylon, and others. [h] Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective coating resins. [i] Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.

Photos courtesy Bakelite

Evacuation plane floor is paper-based laminate made with phenolic resins

Plane Fittings

AMONG the modifications made in the C-54M evacuation plane by Texas Engineering & Mfg. Co., Grand Prairie, Texas, to make it more comfortable for airborne patients are protective flooring and draperies for litters, both using Bakelite plastics.

The attractive flooring is a paper-based laminate produced with Bakelite phenolic resins by Consolidated Water Power & Paper Co., Wisconsin Rapids, Wis. When combined with plywood or bass wood, it is also used for bulkhead panels, ramps, and seats. Its value in aircraft lies in its high strength-weight ratio and resistance to chemicals, abrasion, and temperature changes.

The Coryl litter draperies, made of Vinylite film by Decora Corp., New York, N.Y., are easily cleaned, and will resist disinfectants, alcohol, surgical solvents, and detergents, and provide individual privacy.

Vinyl litter drapes are resistant to chemicals, afford plane patients privacy

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SYNTHETIC ORGANIC CHEMICALS. Booklet containing data on the physical properties, chemical properties, applications, and operating procedure connected with the use of vinyl acetate, paraldehyde, and many other synthetic organic chemicals manufactured by Niacet Chemicals Div., United States Vanadium Corp. (7-800)

PLASTIC MOLDS. Folder containing information about facilities and equipment for the manufacture of plastic molds of all sizes and types available at Eagle Tool & Machine Co. (7-801)

THERMOSETTING MOLDING POWDERS. Up-to-date information on GE molding powders which conform to U. S. Government Specification MIL-P-14A. Includes description, powder properties and molded properties of each type. General Electric Co. (7-802)

ELECTRONIC WOOD GLUING. Information about Thermatron electronic heating equipment for high-speed drying of glues and for facilitating wood bending. Thermatron Div., Radio Receptor Co., Inc. (7-803)

GOVERNMENT SPECIFICATIONS ON LAMINATED PLASTICS. Handy chart showing the various grades of Synthane laminated tubes, rods, and sheets and their corresponding MIL, Military Type, Navy, JAN, and A.S.T.M. designations. Synthane Corp. (7-804)

REINFORCED PLASTICS. Magazine reprint containing data on molding and fabricating, properties and design factors, and industrial and consumer applications of reinforced plastic materials. Owens-Corning Fiberglas Corp. (7-805)

LABORATORY MACHINES. Illustrated booklet containing specifications of various Sturtevant laboratory crushers and grinders for reducing the size of a variety of materials. Sturtevant Mill Co. (7-806)

MASKS FOR PLASTICS. Information about and samples of various custom-cut adhesive-backed masks and stencils for use in decorating and protecting plastics products during painting, etc. Gleicher Mfg. Corp. (7-807)

INJECTION MOLDING PRESS. Specification sheet containing detailed data about the features of the S.H.8/10 plastic injection molding machine (10-oz. capacity) manufactured by R. H. Windsor Ltd. (7-808)

"VINYLITE" FOR APPLIANCE WIRING. Underwriter's Laboratory report on Vinylite QG-5909 for 80° C. appliance wiring. Bakelite Co., Div. Union Carbide and Carbon Corp. (7-809)

PRINTING INKS AND TOPPINGS FOR VINYL. General information on the pigments, dyes, thinners, and other materials available for printing and topping vinyl film. American Resinous Chemicals Corp. (7-810)

HYDRAULIC PRESS MANUFACTURE. Handsomely illustrated brochure showing the machines and other facilities used to manufacture hydraulic presses, valves, and allied equipment. R. D. Wood Co. (7-811)

SLUSH MOLDING. Reprint from "Modern Plastics Encyclopedia" containing informative data on many phases of slush molding vinyl plastisols. Watson-Standard Co. (7-812)

VINYL STABILIZER. Technical service report on Witco lead stearate No. 50, a primary heat stabilizer and internal lubricant for polyvinyl chloride resins and copolymers. Witco Chemical Co. (7-813)

ELECTRIC HEATING UNITS. Complete catalog on Chromalox heating units and equipment. Includes data on use, construction, application, prices, and standard ratings of most types of electric heating units. Edwin L. Wiegand Co. (7-814)

WORK FEED TABLE. Booklet containing installation photographs and detailed descriptions of the Bellows rotary feed table for feeding work to automatic machines. The Bellows Co. (7-815)

"TEFLON" DISPERSIONS. Bulletin describing the properties and general processing characteristics of Teflon dispersions for use in chemical, electrical, and non-adhesive applications. E. I. du Pont de Nemours & Co., Inc. (7-816)

CHEMIGUM RUBBERS. Booklet containing data on the various types of Chemigum rubbers, their specific properties, the compounding techniques involved in their use, and suggested compounds for a number of typical applications. Chemical Div., The Goodyear Tire & Rubber Co., Inc. (7-817)

WORK GLOVES. Folder describing several styles of Jomac heat- and flame-resistant flexible work gloves. C. Walker Jones Co. (7-818)

GEON LATICES. Chart containing information on the characteristics of several water dispersions of polyvinyl chloride base resins with applications in package coatings, paper impregnating, etc. B. F. Goodrich Chemical Co. (7-819)

HYDROLUBES. Information on the use and advantages of Ucon Hydrolubes, fire-resistant hydraulic oils for use in locations where fire hazards exist. Carbide and Carbon Chemicals Div., Union Carbide and Carbon Corp. (7-820)

FABRICATING PLEXIGLAS II. Description of proper methods for fabricating, forming, cementing, and annealing Plexiglas II. Includes list of physical properties and table of recommended minimum oven temperatures for various types of forming. Rohm and Haas Co. (7-821)

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STANDARD MOLD BASES. Engineering drawings and specifications on all articles sold and services rendered by Detroit Mold Engineering Co. (7-836)

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MOLDING OF PLASTICS. A pictorial presentation of the facilities available at General Industries for engineering, mold making, compression, transfer, and injection molding, and finishing of custom-molded plastics. The General Industries Co. (7-842)

POLYETHYLENE FILM. Given is data on Ger-Pak polyethylene film which is reported to be flexible at low temperatures, have low moisture-vapor transmission, be heat sealable, non-toxic, tasteless and odorless, etc. Gering Products, Inc. (7-843)

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Photos courtesy Bakelite Co.

Water-filled vinyl pontoons give inflatable vinyl boat greater stability by acting as counter-ballast to prevent tipping when lifted out of water by shift of weight in boat

Improved Inflatable Boats

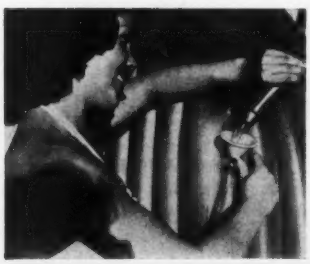
THE seaworthiness of inflatable boats has been improved by the addition of water-filled pontoons which keep the craft stable in rough water and steady on its course under paddling. Both the 6-ft. boat and pontoons are made of Bakelite vinyl sheeting, which is resistant to salt water, oils, greases, temperature changes, and abrasion, and is easily cleaned with soap and water. Bilnor Corp., Maspeth, Long Island, N.Y., manufactures the newly designed inflatable craft.

The boat itself has four separate inflatable side air chambers with tire-type valves, which are inflated and deflated in the same manner as a football or basketball. The pontoons, which are filled with water from a garden hose, are sealed on each side of the inflated bottom. When the boat is afloat, the water-filled pontoons represent no added weight.

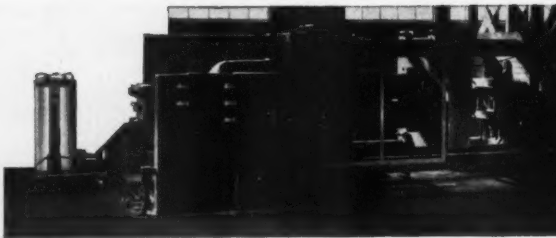
In heavy surf, the pontoons keep the boat stable. If the occupants tilt the boat in calmer water by shifting all the weight to one side, part or all of the pontoon on the opposite side is lifted out of the water so that it acts as a counter-ballast and prevents the boat from tipping over. In addition, the pontoons function as semi-rigid keels which steady the boat while it is being propelled with a single or double paddle.

Thoroughly tested at Florida Cypress Gardens, the boat has been found suitable for camping trips, overland portage, as an extra dinghy, and for all-around water sports use. When it is inflated, it carries two adults and two children; deflated, it weighs about 5½ lb. and folds into a small package which measures only 16 in. square and 4 in. high.

Water from hose fills vinyl pontoon, two of which are sealed to boat bottom



world's largest injection molding press



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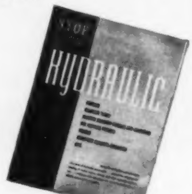

● This 69-ton, 300-ounce Watson-Stillman press accommodates dies up to 72" x 48". One of 14 injection molding machines at Amos Molded Plastics, Edinburg, Indiana, it employs a 7½-ton, 550 gallon hydraulic oil pumping unit (shown above being serviced by Honan-Crane Oil Purifier). Hydraulic equipment at Amos Plastics has been protected by Honan-Crane Purifiers since 1942.

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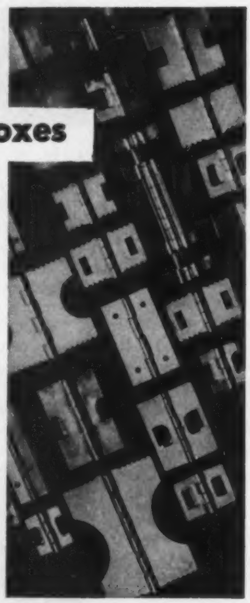

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Courtesy Linde Air Products Div.

Oxidizing oxy-hydrogen flame polishes the ground edges of sized acrylic bars

Flame Polishing

DURING the past few years the process of flame polishing plastics has commanded increasing interest. Three years ago the technique was successfully applied only to acrylics; today its use has grown to include polyethylene and a number of the styrene plastics as well. (See "Flame Polishing With the Oxy-hydrogen Torch," MODERN PLASTICS, May 1948, p. 119).

Flame polishing eliminates the expensive and time-consuming grinding and polishing processes formerly required to produce smooth, transparent surfaces on sawed edges. Parts to be flame polished are first cut to the proper size on a band saw and are then positioned on a table with the surface to be polished facing up.

Using a Purox No. 5 blowpipe, an oxidizing oxy-hydrogen flame is passed over the edges to be polished. Natural gas, city gas, or propane can be satisfactorily substituted for hydrogen. Rough-sawed edges usually require two passes of the flame at a speed of 10 to 20 ft. per minute. The first pass removes saw marks and imperfections; the next leaves a clear smooth surface.

In some cases flame polishing is sufficient to restore the transparency of sawed surfaces, but particularly rough edges may require preliminary sanding before the flame finishing treatment. In such cases, the edges are ground with 150-grit paper; if extreme precision is required, the edges are reground with 320-grit paper.

Uses of Graphite-Filled Phenolic

PHENOLIC filled with graphite is being widely used to mold small parts which must have a low coefficient of friction. In applications such as bearings, caster wheels, and slide blocks, the use of the graphite filler often solves friction problems by making the parts self-lubricating.

A typical application of graphite-filled phenolic is the Sturdico bearings molded by The W-L Molding Co., Kalamazoo, Mich. These bearings were developed for use as drawer rollers in kitchen ranges, and are also being used in metal office furniture. They are molded of a Resinox material modified by the molder and are available in sizes ranging from ¾ to 2½ in., O.D. They are considerably less expensive than ball bearings, are quiet in operation, and are long wearing.

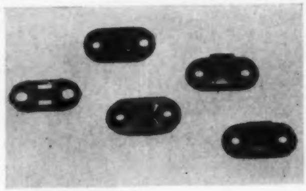
Another interesting application of graphite-filled phenolic is the actuator ring of the centrifugal starting switch in split phase motors made by Emerson Electric Mfg. Co., St. Louis, Mo. In operation, two phenolic contacts at the end of a fork ride against the face of the actuator ring. The actuator rings were formerly produced from a standard wood flour phenolic material. But friction caused trouble.

This problem was solved by the substitution of a graphite-filled Bakelite phenolic for the ring. The result was a smooth, quiet-running, durable mechanism. The phenolic parts are molded for Emerson by Chicago Molded Products Corp., Chicago, Ill.

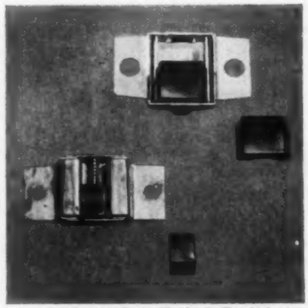
Another molder of graphite-filled phenolic is the Plastics Div., Continental Can Co., Inc., Cambridge, Ohio. This company is producing caster wheels in various sizes and is also molding a graphite-filled phenolic slide block for the Toledo slicing machine.

Reid Products Div., Standard Products Co., Cleveland, Ohio, uses graphite-filled phenolic in the wedges which prevent truck doors from rattling as the chassis vibrates. The door support consists of a spring-loaded sliding wedge mounted on the door frame and a contact member mounted on the door itself. Both the sliding wedge and the contact member are molded of a medium-impact cotton flock and graphite-filled Durez phenolic. To provide the contact member with additional strength, a steel insert is molded-in.

Friction is eliminated between phenolic tips of starting switch and actuator ring when ring is made of graphite-filled phenolic

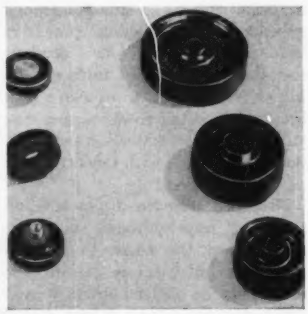


Fixed phenolic wedges in door contact have steel inserts for added strength



Courtesy Durez Plastics & Chemicals, Inc.

Phenolic used in spring-loaded sliding door wedge is medium-impact material



Bearings (left) and casters (right) are produced of graphite-filled phenolic

INSIDE INFORMATION ON INTRICATE DESIGNS

Visual study model of typical four-cylinder gasoline engine, by Philip A. Derham and Associates, Design Engineers, Rosemont, Pa. Machined from solid, clear PLEXIGLAS, the hand-operated model measures approximately 8" x 6" x 4½", and illustrates the action of all moving parts. In machining the intricate model, PLEXIGLAS tolerances were held as close as .001".

This PLEXIGLAS Engine Tells Its Own Inside Story

You can look right into this miniature gasoline engine—see every part and check every detail of operation. Machined from solid transparent PLEXIGLAS acrylic plastic, the hand-operated model shows clearly the action of pistons, valves, cams, connecting rod and crank shaft—from any angle.

Clarity, workability, light weight and durability make PLEXIGLAS especially useful in visual study models, demonstration models, and in general product design and engineering work. It machines easily to close tolerances—forms to almost any curvature when heated—is extremely strong even in very thin sections—and is readily cemented to form strong bonds.

These properties—plus gleaming beauty, a complete range of transparent and translucent colors, and resistance to weather and breakage—give PLEXIGLAS ever-growing importance in *full-scale* manufacturing and merchandising. We'll be glad to send you information on PLEXIGLAS sheets—flat, corrugated, and patterned—and on PLEXIGLAS molding powders.

A steadily increasing percentage of PLEXIGLAS production, now at record levels, is required for the defense mobilization program. The supply available for civilian applications is limited.

PLEXIGLAS is a trade-mark, Reg. U. S. Pat. Off. and in principal foreign countries.
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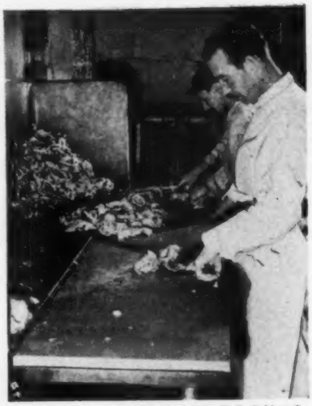


Photos courtesy U. S. Rubber Co.

Cutting board for trimming and boning meat is made of new plastic compound

Cutting Board

INCREASED service life for cutting boards in meat packing plants is the result of replacing wooden boards with boards made of a thermoplastic compound. The new material, high styrene-butadiene combined with buna-N synthetic rubber, is a development of United States Rubber Co. which has tradenamed the product U.S. Royal Cutting Board.

The boards are primarily slated for knife-cutting, trimming, and boning operations in meat packing plants. They have already shown their ability to wear several times longer than wood, do not harbor bacteria, can be kept sanitary with ease. Boards are made in thicknesses of ½, ¾, and 1 in. in sizes up to 42 sq. feet.

Plastic board—being removed from curing oven—is sanitary, outlasts wood

Vinyl in the Greenhouse

A GREENHOUSE gardening process which uses vinyl film extensively in the form of bags, coverings, and linings is producing nearly twice as many plants in the same space for Stanton Co., Holland, Mich. The bags—which replace old-style wooden flats and earthen pots—protect seedlings, keep roots untangled, facilitate controlled plant feeding and changing of crops, and keep work areas sanitary.

Designed by Frederick W. Stanton, president of the company, and fabricated of cast Vinylite film by Avery Enterprises, Inc., also of Holland, the containers are filled with mica or potting soil in which seedlings are planted. The bags are then set on a board in a long, narrow wooden trench lined with vinyl film which resists moisture, mold, mildew, and most chemicals. Through openings in the bottom of the bags the plants absorb chemical nourishment and water which is automatically pumped into the trenches at intervals. Thus, control of plant feeding is facilitated and the life of the trenches is extended because of the protective features offered by the vinyl linings.

In addition to its use in bags for growing seedlings, vinyl film is being used for other purposes in the greenhouse. For example, seeds are planted in flats which rest on benches covered and screened with the plastic film to protect the plants from mice, insects, and drafts and to promote sanitation.

Photos courtesy Bakelite

Rose plant nurtured in vinyl bag can be transplanted without retarding growth

Plants placed in the vinyl bags can be moved about at will without retarding their growth. Rose plants, for example, which are grown in the greenhouse during the off-season, are transplanted outdoors in their vinyl bags in summer, and then returned to the protection of the greenhouse before frost.

Bags made of cast vinyl film contain tomato seedlings, are set in vinyl-lined trenches. The plastic film is unaffected by nutrient solution which is pumped into the trenches

Safety Clothing

PROTECTION against dangers involved in handling liquid rocket propellants is afforded to U.S. Air Force ground crews by a new clothing assembly consisting of a coverall and hood fabricated of vinyl-impregnated glass fiber, butyl rubber boots, and vinyl-coated gloves. A plastic visor in the hood provides the wearer with ample front and side visibility.

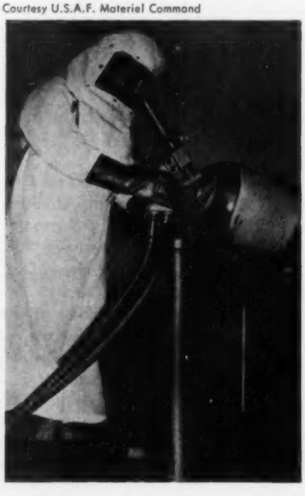
The outfit is the result of several years of research conducted by the Clothing Branch, Aero Medical Laboratory, U.S.A.F. Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio.

The finished product has two alternative methods for internal cooling: air cooling and water evaporation. The air-cooling system utilizes an air-ventilated harness attached to a nylon suit worn beneath the protective coverall. Plastic tubes disperse the air equally throughout the interior of the assembly. Circulating air is supplied from an expansion turbine to the harness through plastic tubing.

In the evaporation system, an outer shell of mercerized cotton, which fits over the coverall, is saturated with water, thus reducing overheating. A demand-type air breathing apparatus is provided to protect the respiratory system.

Water or air cools protective clothing made of vinyl-impregnated glass fiber

Courtesy U.S.A.F. Materiel Command



S. P. I. Meeting

(Continued from p. 88)

chemical urea, but up until lately there has been a shortage of formalin for formaldehyde. New urea molding material capacity is coming in rapidly. Early shortages are in prospect for melamine because military demand for calcium dicyanamid will determine melamine's availability until more capacity comes in.

Formalin itself is now in fair supply but more production of formalin by means of more production of methanol is going to be needed if plastics expand rapidly.

It is important that the consuming Plastics Industries more accurately project their future requirements so that the chemical companies making basic raw materials can find the capital and engineering brains to accomplish the expansion required. A smooth growth is desired.

"The Army's Use of Plastics," *by Dr. Warren Stubblebine, Research Director, Chemicals and Plastics Section, Research & Development Branch, Office of the Quartermaster General.*

The excitement over the polystyrene shortage caused several withdrawals of procurements for items such as polystyrene spoons, but this situation has since been corrected. Army uses of vinyls, mainly in the form of coated fabrics, continue at a fairly high level.

Phenolic-rubber blends are being considered to replace leather for garrison cap visors, and light-weight sheeting coated with these materials may replace duck in many items.

One of the Army's most important fields of interest is in the low pressure laminate field—but the majority of items are still in development.

"The Status of Existing and Proposed NPA Regulations Affecting the Plastics Industry," *by George H. Sollenberger, Chief, Thermoplastics Unit, Plastics Section, Chemical Div., National Production Authority.*

The basic operating policy of the Chemical Div. of NPA is one of "hands off" as far as possible. Section 19 of Order M-45 provides for a method of releasing material for free use after specific allocations have been made to top-level uses. It is the division's belief that the distribution

Development of this .0017-inch film is of particular interest for the packaging and protective materials fields as well as for household applications of film such as draperies, since it affords the economy of a thin film while still retaining the advantages of a calendered product. It is available from Ross & Roberts in a variety of colors and widths.

.0017-INCH UNSUPPORTED VINYL FILM

Produced On Farrel Z-Type Calender

Now, for the first time, 1.7 gauge, calendered, unsupported vinyl film is being produced on a commercial scale. The manufacturer, Ross & Roberts, Inc., of Stratford, Connecticut, credits the development of this exceptionally lightweight film to new techniques in calendering and to Farrel-Birmingham's Z-type calender.

The Z-type four-roll calender was designed by Farrel-Birmingham for just such precise production as this—production that demands extreme accuracy of gauge and temperature control. The verigraph charts show how consistently the required gauge can be maintained by this machine in running vinyl film.

In addition to unsupported plastic film, Z-type calenders are ideally suited for producing sheet and for single and double coating. They are available in a wide range of sizes, from small experimental machines to large production sizes.

Farrel-Birmingham engineers will be glad to discuss your calendering requirements with you at any time. Or, for general information about Farrel-Birmingham rubber and plastics calenders, send for a copy of new 32-page bulletin, No. 174.

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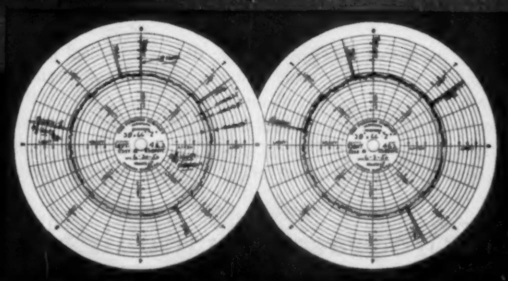
FB-684

...ingham, 28" x 66", Z-type, four-roll calender in- [illegible] Ross & Roberts plant.



Verigraph charts showing extreme accuracy of gauge in running vinyl film on a Z-type calender. The variation is less than plus or minus .0001 inch.

of such "free" material on the basis of purchasing history is both equitable and in keeping with the law.

"Comments on Activity of Select Committee on Small Business of the United States Senate," *by Walter Stults, Professional Consultant to the Senate Committee on Small Business.*

The Senate Small Business Committee is trying to assure a just and equitable allocation of materials to all producers, whether large or small. It is also working with the Defense Department to guarantee the maximum participation by small business in the military procurement program. The committee is also working to see that laws now on the books and bills now pending do not hit small business more heavily than necessary.

Representatives of the plastics industry made a great impression on the members of the committee during the hearings on shortages.

As a result: the percentage of styrene in GR-S has been reduced; all styrene directed toward the synthetic rubber program which has not been used has been immediately allocated back to normal peacetime uses; and all mobilization planners have been made aware of the importance of the plastics industry.

"Report on S.P.I. Thermosetting Molders' Committee for National Defense," *by John J. Bachner, vice president Chicago Molded Products Corp.*

The Thermosetting Molders' Committee has been working with officers of NPA, OPS, and Defense Program groups to assure that the Industry will be given an opportunity to play an important part in the defense program, and that it will not be stymied as to materials by any misunderstanding of its importance in the economy.

"OPS Regulations Affecting the Plastics Industry," *by W. L. Bossart, Chief of the Plastics and Resin Section; Rubber, Chemical, and Drug Div.; Office of Price Stabilization.*

On July 2, 1951 (since an extension was granted from May 28, 1951) the Industry as a whole will operate under the Manufacturers' General Steel Price Regulation, also known as CPR 22. This order is of an interim nature from which specific or tail-

ored regulations will come as the next step. OPS requests that the Industry make available for a limited time certain executive personnel to act as consultants to assist in the development of suitable orders and to provide double check for facilitating increased production for the defense effort. Cooperation of the Plastics Industry's Advisory Committees and sub-committees has been notable.

"The Fleet and Its Plastics," *by Dr. Albert Lightbody, Chief, Chemistry Div., U. S. Naval Ordnance Laboratory, White Oak, Silver Spring, Md.*

Experiments with plastic airplanes, plastic armor, and plastic boats will continue on a wider and larger scale. Plastic missiles are becoming a reality. Plastic components in ammunition and expanded plastics for flotation show great promise. It is quite possible that some day ships will have plastic decking, masts, and hulls. It is even possible that propulsion units and gun mounts will yield to the impact of plastics.

"Report on S.P.I. Injection Molders' Committee on National Security," *by Elmer E. Mills, president, Elmer E. Mills Corp.*

An industry-wide meeting of injection molders was held in New York on October 9, 1950, at which time this Committee was organized.

On January 10, 1951, the Committee submitted to Dr. J. R. Steelman, assistant to the president of the United States, and to NPA its recommendations on how the shortage of polystyrene might be alleviated.

On January 25, 1951 representatives of the Industry appeared before the Senate Small Business Committee, which recommended our reappraisal of defense and stockpile requirements and better planning of defense programs designed to channel contracts to those industries or sub-groups hardest hit by cutbacks.

National Production Authority has been channeling back into plastics all unused monomeric styrene released by the fact that the synthetic rubber program consumed less in the first quarter of this year than was expected. Furthermore, the bound-styrene content of the rubber is being reduced under test from 25.5 to 20%.

A letter from Manly Fleischmann, Administrator of NPA, to Wm. T. Cruse, executive vice president of S.P.I. and dated May 17, 1951, declares that the synthetic rubber producing capacity is being expanded from 760,000 long tons per year to 860,000. However, by August of 1951, the switch-over to lower styrene content rubber is expected to be effective to the extent of 70 to 75% of total GR-S production, and further experiments are being conducted on rubber with a 16.5% styrene content, which again can release more styrene monomer for plastics.

Increased production of styrene monomer is planned as shown in Table I.

Committee Meetings

Meetings of several committees of S.P.I. were held during the conference, and recommendations for the consideration of the Board of Directors were drawn up.

It was formally announced that the Fifth National Plastics Exposition, sponsored by S.P.I., will be held March 11, 12, 13, and 14, 1952 at the Convention Hall in Philadelphia, Pa. Management of the Exposition and of publicity and advertising will be directed by Clapp and Poliak, Inc.

Table I—Increase in Production of Styrene Monomer, in 1000 Pounds

	Est. available production		*Est. Rub. Res.*	*Amt. Over*
	Increase	*Total*	*Requirements*	*Rub. Res. Req.*
1951				
2nd Quarter	—	150,000	79,500	70,500
3rd Quarter	8,000	158,000	87,000	71,000
4th Quarter	19,500	169,500	94,400	75,100
1952				
1st Quarter	26,250	176,250	96,000	80,250
2nd Quarter	26,250	176,250	97,600	78,650
3rd Quarter	47,570	197,570	98,400	99,170
4th Quarter	58,250	208,250	98,400	109,850

Absorbed Water

(Continued from pp. 107-110)

Calculations made in this way are reliable to ±30% unless the plate is ⅛ in. thick or less, in which case the estimated answer is high.

Example 6 — What is the warp of a plate of material D (two-step, fabric-filled), 0.125 in. thick, and 5 in. in length and breadth, exposed on one side to 100% relative humidity at 25° C. for 250 hr., the other side being dry? Solution: In using Fig. 4 we calculate t exactly as in Equation (1) and Example 1. Now $D = 1.5 \times 10^{-5}$ cm.² hr.⁻¹. Hence

$$t = 250 \times \frac{1.5 \times 10^{-5}}{1.0 \times 10^{-5}} \times \left(\frac{0.125}{0.125}\right)^2 = 375 \text{ hr.}$$

Hence d/d^1 from Fig. 4 = 0.89. But $K_1 = 0.13/100$, $S = 5.4$, $L = 0.125$, and $b = W = 5$. Hence

$$d^1 = \frac{0.13}{100} \times \frac{5.4 \times 25}{8 \times 0.125} \left[1 + 1\right] = 0.35 \text{ in.}$$

and actual warping, $d = 0.89 \times 0.35 = 0.31$ inch.

Example 7 — What is the warp of material D under the conditions described in Example 6, except that the thickness is 0.25 inch? Solution: In this case t = 93.7 hr. and $d/d^1 = 0.54$. But $d^1 = 0.175$ in. (compared with 0.35 in. for the ⅛ in. thick plate; a thicker plate *always* warps

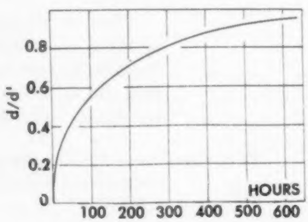


Fig. 4—Warping as a function of time. $D = 1 \times 10^{-5}$ cm.² hr.⁻¹; $L = 0.125$ inch

less than a thin one under the same conditions) and hence actual warping = $0.54 \times 0.175 = 0.095$ inch. Note that the low value of K_1 for this material reduces warping.

Example 8 — What is the warp if the humidity on one side is less than 100%? Solution: As in Examples 3 and 4 we can find only comparative answers useful in comparing thicknesses and different materials. Proceed exactly as in Examples 6 and 7 but use kS instead of S and get answers in terms of k.

Cylinder With Both Walls Wet

When a cylinder is absorbing water at the same rate at the inner and outer surfaces, the changes can be calculated in much the same way as for a plate. Thus: 1) calculate water absorption as in Example 1 or 3 using thickness of cylinder wall; 2) calculate change in length and in mechanical properties as in Example 5. However, 3) calculate percent expansion in outer diameter as

$$Q\,[K_1 + M\,(K_t - K_1)\,],$$

expansion in inner diameter as

$$Q\,[K - M\,(K_t - K_1)\,],$$

and change in wall thickness from these two, where Q = percent of water absorbed, M = factor having a value of 0.05 for a wall thickness up to 10% of outer radius and a value of 0.10 for a wall thickness up to 20% of outer radius.

Example 9 — What are the dimen-

sional changes in a cylinder of material G (one-step, woodflour-filled) having an inner radius of 1.0 in., an outer radius of 1.2 in., and a length of 5 in. when water absorption is 4.0%? Solution: Percent change in length $= 4.0 \times k_1 = 4.0 \times 0.23 = 0.92\%$ and actual change in length $= 5 \times 0.0092 = 0.046$ inch. Wall thickness = 0.2 in. = 16.6% of outer radius. Thus, use $M = 0.10$. Also $K_1 = 0.5$ (Table I). Hence percent change in outer radius $= 4.0\ [0.23 + 0.10\ (0.5 - 0.23)] = 1.028\%$ and actual change $= 1.2 \times 0.01028 = 0.012$ inch. Percent change in inner radius $= 4.0\ [0.23 - 0.10\ (0.5 - 0.23)] = 0.812\%$ and actual change $= 0.00812$ inch. Hence thickness changes from 0.2 in. to $0.2 + (0.012 - 0.00812)$ or from 0.2 to 0.204 inch. Precision here is about ±30%.

Cylinder With One Wall Wet

There is an expansion in internal and external diameters, in wall thickness, and in length. Expressed as a percentage, all these expansions are the same. If water is against either wall, each expansion eventually reaches 0.49 K_1S. At lesser times it is a fraction of this value that can be calculated from Fig. 5 in the manner that Example 1 used Fig. 2. As before, calculated values are good to about ±30%.

Example 10 — A cylinder of material C (two-step, woodflour-and-mineral-filled) has a wall thickness of 0.1 in., an internal radius of 1.0 in., and a length of 8 inches. What are the dimensional changes when water at 70° C. is against the inside face for 48 hours? Solution: By the procedure of Example 1, D at 70° C. $= 8.3 \times 10^{-5}$ cm.^{2} hr.$^{-1}$. Hence

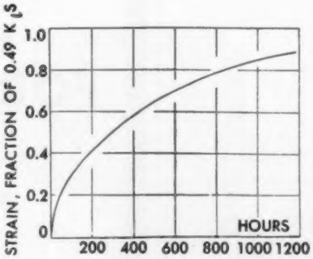


Fig. 5—Expansion strains in a wet-dry cylinder when $D = 1 \times 10^{-5}$ cm.^{2} hr.$^{-1}$, and the wall thickness is 0.095 inch

$$t = 48 \times \frac{8.3 \times 10^{-5}}{1.0 \times 10^{-5}} \times \frac{(0.095)^2}{(0.1)^2} = 360 \text{ hr.}$$

From Fig. 5, corresponding expansions are $0.55 \times 0.49\ K_1S$ or $0.27\ K_1S$ or 0.41%. Hence length expands 8×0.0041 or 0.0322 in., inside radius 0.0041 in., outside radius 0.0045 in. and thickness 0.0004 inch.

If humid air were against the inside face, expansions could be calculated for various materials using a constant factor, k, as in Example 3.

The stresses created in a cylinder are often more important than the expansions and vary through the wall from maximum tension at the dry face to maximum compression at the wet face. These stresses are like those imposed in a flexural test. Unlike the stresses in a plate, these stresses can build up to a point where, by themselves, they are able to cause cracking and failure. At the dry face the eventual tension reached is $0.7\ EK_1S$ where E = modulus of elasticity. The tension at any intermediate time is calculated from Fig. 5, multiplying the fraction corresponding to a certain time by $0.7\ EK_1S$ instead of $0.49\ K_1S$.

Example 11 — What is the tension stress at the dry surface for the

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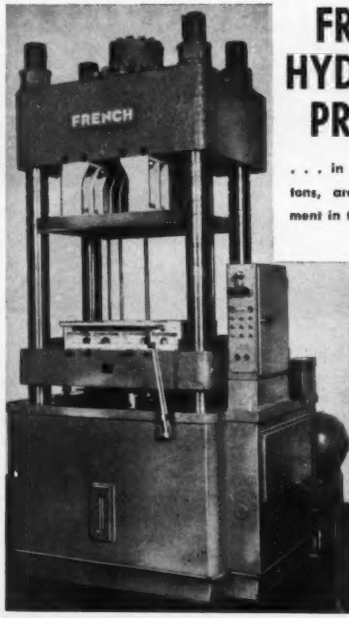

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cylinder in Example 10? Solution: As in Example 10, fraction is 0.55. Hence stress = $0.55 \times 0.7\ EK_1S = 0.385 \times 1 \times 10^6 \times 0.0024 \times 6.3$ where $E = 1 \times 10^6$, $K_1 = 0.0024$ in./in., and $S = 6.3\%$. Hence the stress = 5800 p.s.i. Maximum stress that can be reached = $0.7\ EK_1S$ = 10,600 p.s.i.

If we calculate the maximum stresses for all the materials of Table I, using a modulus of one million p.s.i., we find the following: A — 13,500, B — 1680, C — 10,600, D — 4900, E — 6100, F — 9000, G — 10,600 p.s.i. For flexural strength of about 10,000 p.s.i., materials A, C and G would fail as soon as the maximum stress were reached. Materials D and E would last several months at least after equilibrium were reached, but the sustained stress might cause eventual failure. Material B seems in no danger of failure.

A partial answer to this problem is to make the wall thickness as great as possible and choose a material with a low diffusion constant so that the danger level is approached as slowly as possible and the useful life of the part is thus extended.—END

Unplasticized PVC

(*Continued from pp. 112-118*)

plastic. A modified machine constructed in 1947 was furnished with a heated torpedo and small slots between torpedo and wall, and all surfaces coming into contact with the hot plastic were chromium plated. Combs, spectacle frames, pen and pencil barrels, small bottles, terminal battery tops, and similar articles were made in this machine. Due to its good dielectric constant and dissipation factor, capacitors and other radio parts were also injection molded of the unplasticized polyvinyl chloride, although as a polar molecule (17) it does not have the same low dissipation factor as polyethylene or polystyrene (note data in Table I).

Ram Extrusion—The same principle as used for the extrusion of light metal alloys is employed for the manufacture of rigid tubes and rods of polyvinyl chloride. In 1944, 15 ram extruders were in operation in Germany. The jackets of the horizontal extruders are preheated to 160 to 170° C., the die and torpedo to 200 to 220° C. The premilled hot

billets (about 45 to 50 lb.) containing 2% lubricant and stabilizer were placed inside the cylinder of the extruder and extruded at once by pressure of about 1000 p.s.i. applied hydraulically to the piston. The movable heater of the torpedo has to be removed before extrusion. The shape of the dies is similar to those of the normal screw extruders and designed in such a way that the pressure increases continuously as the plastic passes through the die. Each ram press is fitted with two extrusion heads, movable perpendicularly to the direction of extrusion; this arrangement permits cleaning of one die during the 0.5 hr. when the other is in operation. The pipe or rod extruding with an average speed of 6 ft./minute runs into a slightly downward sloping V-shaped trough and is cut off when 10 ft. have been extruded. The hot plastic is either transferred to a second trough to cool or rotated slowly between cylinders to maintain the shape. It was found that this last precaution is unnecessary, as deformation occurs only shortly after coming through the die and not during the cooling period below 60° C. When one batch has been extruded, the machine is opened, excess polyvinyl chloride is cleaned out, and the second head, cleaned in the meanwhile, is put in place.

Polyvinyl chloride pipes are used in the chemical and related industries for handling inorganic and organic acids, alkalies, salt solutions, hydrogen peroxide, and oil; and for the manufacture of coolers and similar equipment. In laying the pipe lines, the thermal expansion of the plastic (Table I) has to be considered. In contrast to metals, where the molecules are held together by primary valences, the molecules of polyvinyl chloride are linked only by Van der Waal's forces resulting in a greater expansion (about three times higher than aluminum or six times higher than iron). Oriented materials show a smaller expansion in the direction of orientation than perpendicular to it. If thermal expansion is not allowed for, stress concentrations of 500 p.s.i. occur at 30° and 800 p.s.i. at 50° C.

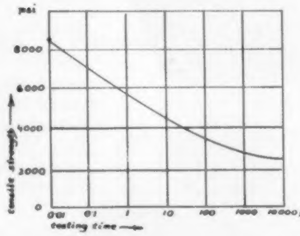


Fig. 5—Endurance of unplasticized PVC

The thermal conductivity of polyvinyl chloride is very small in comparison to metal; therefore, polyvinyl chloride pipes are used without insulation for piping preheated or cooled liquids (brine, beer, etc.). But the temperature range is limited by the softening point and brittle temperature of the plastic.

The mechanical properties of polyvinyl chloride pipes and rods, given in Table I, were determined in short time tests (3 minutes). The following relation was observed between the various stresses, taking the tensile strength as 100%: compressive 135%; bending 200%; distortion 80%; and shear strength 70%. If the pipes are under constant pressure or stress, the effect of cold flow

has to be taken into consideration. The decrease of tensile strength with time is shown in Fig. 5. After about 1 month, only a third of the original short time strength is retained. The use of polyvinyl chloride pipes under pressure has to be limited (Fig. 6) to a maximum temperature of 40° C. (18).

In house installations, polyvinyl chloride pipes have been used for no-pressure sewage pipings. Notches influence considerably the mechanical properties. Bending and connecting of two pipes are done by means of hot air or a blow torch. The pipes have to be rotated, as in glass blowing, until the material gets soft. Bending must be accomplished at a high temperature, otherwise flow occurs at the working temperature (Fig. 7). In joining two pipes a reamer is inserted to widen the heated pipe to such a diameter that the other pipe just fits inside. After cooling, the reamer is withdrawn and the two pipes are stuck together with an adhesive consisting of a solution of after-chlorinated polyvinyl chloride or copolymer in methylene chloride or acetone or straight polyvinyl chloride in tetrahydrofuran (5). Joints are also made with flanges or threaded joints.

For the operation of welding the edges of the pipes are beveled, as in metal welding, and a hot-air torch, heated by city gas or hydrogen, is used. The diameter of the jet is

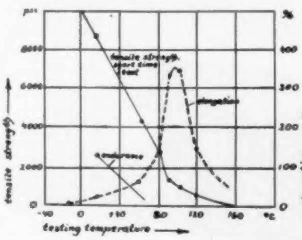


Fig. 6—Stress-strain of polyvinyl chloride at various temperatures

about 0.1 in. and the temperature 190 to 210° C. The welding rod, of 0.2 in. diameter, containing 10% plasticizer in order to have a lower softening point, is held perpendicular to the weld seam and fused with the polyvinyl chloride pipe or sheet in the hot air stream (19).

The largest pipe extruded on ram extruders is 10 in. in diameter. Larger pipe is welded up from laminated polyvinyl chloride sheets which have been heated and bent round a former.

Screw Extrusion—Welding rods, small pipes, canes (rattan), tapes, and bristles of unplasticized polyvinyl chloride are made in horizontal screw extruders. Besides standard extruders of 1 to 2.5 in. screw diameter, double screw extruders (20) are employed, bringing about a better mastication of the polymer. The temperature in the barrel is kept at 120 to 160° C., increasing from the hopper to the die. The die itself is maintained at 175 to 200° C. The machines are fed either with broken flakes or small strips from the premilled crepe sheets of stabilized and lubricated polyvinyl chloride. The take-off rate is in the neighborhood of 60 ft./minute.

The polyvinyl chloride canes are used by chair weavers or for seat covers, and the filaments for sieves, screening, battery separators, and the like. Film and sheeting are made by extrusion through a slit die. Thin walled packaging films of 0.001 in.

thickness and less can be manufactured by the technique of inflated tube extrusion (21) from polyvinyl chloride having a content of 10% plasticizer.

Bristles of 0.01 to 0.04 in. thickness are made in this country from copolymers to the extent of 250,000 lb./year. Bristles of straight polyvinyl chloride are not yet made here, but have been manufactured for 10 years in Germany, having reached an annual capacity of 1,500,000 lb. in 1944. Horizontal or vertical extruders with 1 to 2.5 in. screw diameter are used. The dies, made of stainless steel, nickel, or chromium, have a mesh filter in front to remove impurities. The holes (3 to 72) of the die are bored conically, and the whole inside of the head is constructed with streamlined contours. After 6 to 12 hr. of operation, the die has to be cleaned by washing with tetrahydrofuran or some other solvent. The extrusion machine

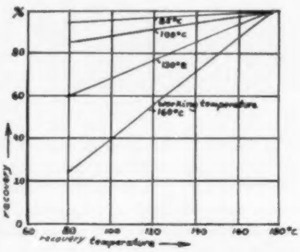


Fig. 7—Recovery of polyvinyl chloride rods deformed at various temperatures

itself in continuous use needs only to be taken apart once every 2 to 3 months. Approximately 40 to 60 lb./hour of 0.02 in. diameter bristles can be extruded through a die with 72 holes from a 2.5 in. extruder.

The extruded bristles are stretched between two pulleys 200 to 400% by passing through boiling water or steam (22), run under tension through cold water, and wound on reels with friction couplings to form skeins weighing about 12 pounds. In making monofilaments, each strand has to be spooled up separately. The highest present wind-up speed is 750 ft./minute. To remove internal strains, the stretch oriented bristles have to undergo an annealing process (23). Polyvinyl chloride bristles are used in street-cleaning brushes,

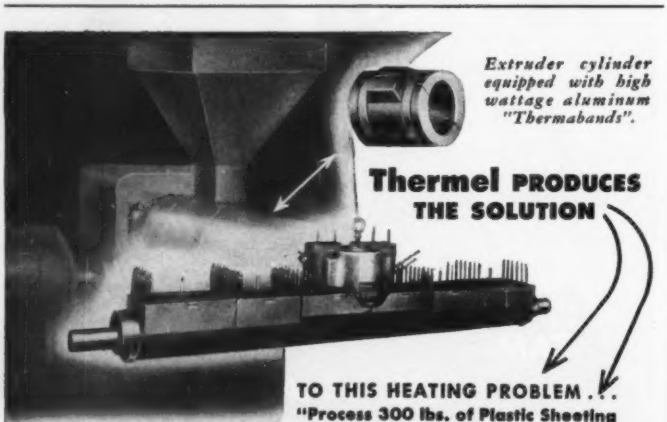
curry brushes for horses and cattle, bottle and can cleansers, industrial brushes, floor- and carpet-sweeper brushes, and paint brushes.

Very fine bristles or fibers cannot be made by extrusion, as the diameter is limited by the impurities. The thermoplasticized mass can only be filtered through a wire gauze, not through a fine filter cloth.

Spinning—At Burghausen, straight polyvinyl chloride was processed into fibers by dissolving in cyclohexanone and spinning into a precipitating bath containing a mixture of hexanol and octanol. After leaving the bath, the bobbins were transferred to a stretching machine where the yarn was stretched 400% in steam, twisted, reeled, and subjected to an annealing process (23). The addition of dyes, such as Zapon yellow, indanthren yellow, or indanthren green, made the yarn light stable. The mechanical properties of the yarn were superior to those made of copolymers (Table IV), but the process was more expensive and involved the necessity of recovering cyclohexanone from the precipitating bath.

At Wolfen, Germany, 1300 lb./day of PeCe silk was produced in the following way (24): A 28% dope of after-chlorinated polyvinyl chloride was prepared in acetone. Dyes analogous to those used for cellulose acetate or water-insoluble azo pigments, together with 1.5% dioxydiethyl sulfide as light stabilizer (25), were added. The solution was filtered twice at 40° C. and spun in three spinning machines, each fitted with 100 gear pumps (3 cc./min.) and spinnerets. The latter had 120 holes of 0.003 in. diameter. The method was upwards, analogous to that at Burghausen, into glass tubes filled with cold water. The yarn of 120 filaments was stretched 300% between rolls of different speeds and dried at 60° C.

Staple fiber at the rate of 10,000 lb./day was produced at Wolfen by spinning the solution through 78 spinnerets, each with 2500 holes, into water, stretching 300% by five sets of triple rollers, each 60 ft. apart, mechanically crimping, and cutting into staple of 2 in. length. It was also possible to color the finished yarn with acetate dyes or pigments by adding a swelling agent to the dye bath, such as 1 to 2% N-ethyl phenyl ethyl carbamate (Eulysin PC), or a



binding resin at a temperature below 70° C.

A yarn of higher softening point (120° C.) is made from a copolymer of 86 to 87% vinylidene chloride and 13 to 14% vinyl chloride by spinning from tetrahydrofuran solution. But only low molecular weight products of K-values below 65 are soluble in tetrahydrofuran, dioxane, or cyclohexanone.

Because of its low softening point, polyvinyl chloride fiber is of relatively little value for normal textile purposes. It is used for shoe laces, harness yarns, cordage, and cargo parachutes. Because of its excellent resistance to sea water, acids, alkalies, oils, fungus, bacteria, and mildew, together with its non-flammability and non-swelling in water, it is widely used for industrial purposes, such as filter cloth, chemical workmen's clothing, dialysis membranes, paper dryer felts, replacement for burlap, bottoms for tents in the tropics, marine covers, boat ropes, fishing lines, nets, trammels, and the like.

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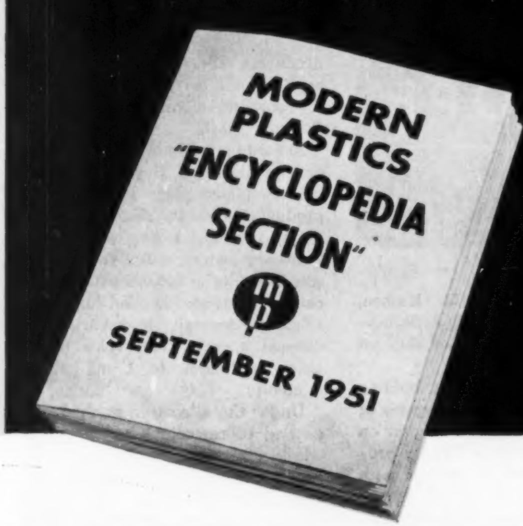

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plications, the special equipment used to process them, basic data on design and production, available sources of supply.

The ENCYCLOPEDIA SECTION is designed to provide exactly this kind of information in concise, clearly understandable form—and at just the time when these answers are most urgently needed.

The ENCYCLOPEDIA SECTION is also designed to help manufacturers in the plastics industry who are seeking government defense work. It will give them a broad picture of the types of plastics applications that will be most urgently demanded by the Armed Forces, together with special lists of government officials responsible for plastics procurement and project development.

For the same urgent reasons, procurement agencies for the Armed Services will be looking for a complete, up-to-date and authoritative directory of plastics molders, fabricators, extruders, converters and suppliers of plastics products. They'll find it in the exclusive Buyers' Directory of the ENCYCLOPEDIA SECTION—the standard reference for all sources of supply in the plastics industry. In Washington, as elsewhere, it will be consulted actively and regularly by the men charged with the task of soliciting bids and authorizing purchase appropriations.

bids and obtaining advance notice of government needs.

2. ENGINEERING and METHODS

3. MACHINERY

Design engineers, production engineers and plant superintendents will have a special stake in these complete roundups of recent developments in production techniques and notable improvements in the design of equipment and machinery used for processing plastics.

4. PLASTICS MATERIALS

Right down the line, this section will round up all the recent developments in the field. Special emphasis will go to three increasingly important material categories: film and sheeting, reinforced plastics, industrial laminates.

5. PLASTICS CHARTS

Fully revised, these exclusive charts depict all the basic chemical and physical properties of available synthetic materials. Through the years, the charts have come to be universally recognized as the standard guide to plastics for engineers, designers and technicians in every branch of American industry.

6. THE BUYERS' DIRECTORY

Completely up-to-date, the Directory will cover every phase of plastics procurement: materials, machinery, supplies, equipment, special services (molding, extruding, fabricating, laminating, finishing, decorating, assembling and designing).

MODERN PLASTICS *575 Madison Ave., New York 22, N. Y.*

THE PLASTISCOPE*

NEWS AND INTERPRETATIONS OF THE NEWS

By R. L. Van Boskirk

New Alkyd Molding Powder

REPORTS have leaked out that a new Plaskon glass-filled alkyd molding powder has been successfully compression molded by several molders who are experimenting with trial lots. It is said that the material has exceptionally high impact strength—four times greater than rag- or cord-filled phenolic—and is comparatively easy to mold in comparison to the fibrous-filled materials which have been most commonly used in the compression molding industry.

The experimental material mentioned above is not to be confused with Plaskon's recently announced "third type alkyd molding compound 422" which is a mineral-filled material similar to the previously announced alkyds. The 422 compound has even higher flame resistance than its predecessors which makes it particularly adaptable in specialized electric jobs and thus broadens the base of alkyd utility.

Comparable in most other respects to the present compounds of this type (Plaskon alkyds 411 and 420), the new 422 is listed as self-extinguishing under A.S.T.M. and Underwriters Laboratories flame resistance tests. Other improved properties have also been built into 422. It is claimed to have better insulation resistance than the older alkyds and twice as good water resistance. Since many electrical systems, particularly those used in military equipment, may be required to operate under damp or humid conditions, the practical importance of this improved moisture resistance is evident.

Small Business Group

MEMBERS of the plastics industry may well be interested in a new organization known as the Small Manufacturers Emergency Committee, with Wendell Berge, former U.S. Attorney General as national chairman and David M. Kasson, president of General Die & Stamping Co. of New York, as national treasurer.

The organization is now holding sectional meetings, and delegates of each section met in Washington on May 24 to establish a definite program and method of contact with government agencies.

The stated purpose of the organization is "to prevent big business from swallowing small business and to work for a share of defense work and the basic raw materials." Another aim of the organization is to keep the RFC functioning, because members claim that the RFC has often been a prime source of long term credit which is necessary to enable a small businessman to stay in business.

Members of the plastics industry who are interested in joining this organization are invited to write to David M. Kasson, General Die & Stamping Co., 262 Mott St., New York, N.Y.; or Mrs. B. Victor, Irwin Woods Advertising, Inc., 2 Bleeker St., Newark, N.J.

Incidentally, it is interesting to note that the Navy recently reported that small business is now getting more than two-thirds of all Navy prime contracts—that from July 1, 1950, through March 31, 1951, more than 330,000 Navy prime contracts totaling $649 million were awarded to small business concerns.

Resorcinol

TWO important events occurred almost simultaneously in the resorcinol industry recently when the material was placed under allocation by the Order Schedule to M-45, May 11, 1951, and Heyden Chemical Corp. announced plans to triple production of its resorcinol capacity.

Total resorcinol production in the United States currently is estimated at 4 million lb., with Koppers Co., Inc., and Heyden as the only producers. The Borden Co. recently applied for a certificate of necessity to construct a resorcinol plant at Tacoma, Wash.

According to John P. Remensnyder, president of Heyden, his firm has completed plans to double the production of its Garfield, N.J., plant—partially destroyed by fire in February—which will give it an annual capacity of 600,000 pounds. The company has also applied for a certificate of necessity to construct additional capacity and raise resorcinol production to 1 million lb. annually.

Under the allocation method now applied to resorcinol, every person who purchases the material from a supplier is required to apply for authorization to accept delivery on Form NPAF-45. Each applicant must specify: grade as U.S.P. recrystallized or technical; the quantity required for each end use; the product to be made from the resorcinol, such as adhesives, dyestuffs, pharmaceuticals, and so forth; the ultimate product end use such as tire cord, arctic tents, ships, prefabricated building construction, and so forth, together with the DO rating, government contract number, and specification number if any. The supplier, of course, must also apply for permission to deliver resorcinol on Form NPAF-46.

There is no small-order exemption for resorcinol. It is reported that present demand is 35% over supply, and that the Armed Forces have found resorcinol adhesives particularly effective.

Polyethylene Coated Drums

POLYETHYLENE coated steel drums, pails, and hackey-type drums are now being produced by Delaware Barrel Co., Inc., Wilmington, Del., for the shipment of materials ranging from edible foods to corrosive acids and alkalies. The company claims that this continuous coating adheres strongly to the steel container and maintains this adhesion continuity under rough shipping conditions.

Substances formerly shipped in containers made of special metals or other materials can now be transported in the coated drums and pails at a fraction of the former cost. Merely washing out the inside reconditions the containers, and they can be reused many times. The

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containers are available in sizes holding 5 to 55 gallons.

Foreign Trade Aids Plastics

EXPORTS and imports of chemical materials are particularly important and interesting in times of scarcity. The figures given here are illuminating in the matter of raw material needed for plastics production. The benzol figure of 23 million gal. imported in 1950 is a life saver for the plastics industry.

Imports of this strategic material in 1951 give promise of being much greater, since almost 10 million gal. were imported in the first two months of 1951 and the import figure from the United Kingdom alone in February was 7 million gallons.

Napthalene, too, was holding up surprisingly well with an import figure running between 8 and 9 million lb. a month for the first quarter of 1951, but importation is expected to decline because Europe needs it for its defense program.

Export figures indicate that the leading customers for plastics from the United States are Brazil, India, France, Italy, and the United Kingdom, exclusive, of course, of Canada.

Exports of polystyrene and vinyls, the top plastics export products of 1950, are still maintaining the 1950 average with shipments running about 2 million lb. a month for polystyrene and between 2 and 3 million lb. a month for vinyls.

Exports of Plastics Raw Materials and Chemicals Related Thereto in 1950[a]

Material	*Amount*[b]	*Leading importers exclusive of Canada*
Benzol or benzene (gal.)	23,300,000	Japan, 120,000; Cuba, 79,000
Napthalene	62,000	Peru, 5500; Cuba, 4800
Phenol	14,000,000	United Kingdom, 1,400,000; Germany, 1,200,000
Cresylic acid	3,000,000	Chile, 2,000,000; Mexico, 560,000
Phthalic anhydride	2,800,000	United Kingdom, 1,500,000; New Zealand, 280,000
Polystyrene	26,500,000	France, 2,000,000; India, 2,000,000; Italy, 1,800,000; Hong Kong, 1,700,000
Vinyl	31,600,000	Mexico, 2,800,000; Italy, 2,700,000; Brazil, 2,700,000; United Kingdom, 1,500,000
Urea and melamine	11,800,000	Mexico, 1,100,000; Brazil, 1,000,000
Cellulose nitrate sheets	540,000	Mexico, 65,000; Brazil, 40,000
Cellulose acetate molding powder	5,800,000	France, 730,000; Mexico, 600,000
Cellulose acetate sheets	950,000	Mexico, 123,000; Japan, 45,500
Casein and other protein plastics	62,000	Mexico, 18,000; Venezuela, 4000
Vulcanized fiber sheets	5,900,000	United Kingdom, 1,300,000; Brazil, 351,000

[a] Source: Bureau of the Census, Dept. of Commerce, U.S.A.
[b] All in pounds unless otherwise designated.

Imports of Plastics Raw Materials and Chemicals Related Thereto in 1950[a]

Material	*Amount*[b]	*Leading exporters exclusive of Canada*
Benzol or benzene (gal.)	23,300,000	United Kingdom, 15,500,000; Poland, 4,800,000
Cresylic acid	3,500,000	United Kingdom, 3,000,000; Czechoslovakia, 330,000
Napthalene	111,000,000	Germany, 61,500,000; Belgium, 14,500,000
Cresol	1,270,000	United Kingdom, 1,000,000; Australia, 112,000
Carbolic acid	114,000	United Kingdom, 70,000; Netherlands, 44,000
Synthetic phenol resins	[illegible]	Switzerland, 40,000; United Kingdom, 1000
Vinyl acetate, unpolymerized	[illegible]	(Only Canada listed)
Vinyl acetate polymer	200,000	Germany, 100,000
Cellulose acetate sheets	89,000	United Kingdom, 79,000; Germany, 500
Cellulose acetate block	133,000	United Kingdom, 69,000; France, 61,000

[a] Source: Bureau of the Census, Dept. of Commerce, U.S.A.
[b] All in pounds unless otherwise designated.

Molded Blanks for Carving

INJECTION molding acrylic blanks for internal carving work by a new method has been announced by Goshen Plastic Enterprises, 198 W. Main St., Goshen, N. Y. When earrings, pendants, and similar items are carved from cast sheet or blocks, considerable hand work is necessary to make round, oval, faceted, or crowned pieces. Goshen's molded blanks are, thus, more economical and are guaranteed to carve satisfactorily. They are now available in three oval sizes with crowned tops and beveled edges. Various other irregular shapes and faceted pieces will soon be added.

Large Acrylic Castings

MASSIVE clear acrylic castings are now in production by Plastic Developments, Inc., Attleboro, Mass. Normally available only up to 2-in. thick, castings from 2 to 6 in. in thicknesses in either raw or finished blocks are made to order by Plastic Developments.

National Plastics Exposition

NEXT plastics exposition, sponsored by The Society of the Plastics Industry, will be held March 11 through 14, 1952, in Philadelphia, Pa., at Convention Hall. Among the reasons for choosing Philadelphia are: Convention Hall does not have a floor load restriction and will permit all exhibitors to be on one floor; it will be a particularly convenient site for military and government personnel from the Armed Services.

Members of the exposition committee are P. Harry Grunnagle, chairman, who is also exhibit manager of Westinghouse Electric Corp.; Henry E. Griffith, Plax; J. F. Nicholl, Lumite; S. J. Helsper, Mack Molding; Fred S. Strauss, Harte; M. Colburn Bailey, Koppers; Dennis C. Guthrie, Tennessee Eastman; Russ Matthews, Bakelite; Herbert S.

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Spencer, Durez; Alan T. Wolcott, General Electric; Corliss Cummins, Dow Chemical; Jack Gillespie, Watson-Stillman; J. R. Turnbull, Monsanto; William T. Cruse, S.P.I.; M. A. Brown, Plaskon; and Ralph Teetsel, Du Pont.

Company Allocations

ONE of our readers, who is president of a large molding company, calls attention in a letter to a serious problem in the distribution of raw materials that is bothering molders to a considerable degree. Mr. B, the president, writes that styrene, for example, is being allocated by the raw material producers on a percentage basis of material bought over a previous period.

He points out that if any molder's purchases over this period were abnormally low, that molder cannot get enough material for the normal recovery of his business. On the other hand, if a molder happened to be running actively over the base period and then had a cutback in his business, he now has more material than he can use and, in order to get new business quickly, he attempts to obtain molds from those people who do not have enough material to keep their particular molds in use. As an example, he says that 22 molds were pulled out of the Midwest territory in the last few weeks and sent to Eastern molders who were running at an abnormal rate in 1950, but are now running at a considerably lower rate.

Another example in another branch of the industry is garden hose. The big production of garden hose is in the early spring, but extruders of garden hose can now obtain only a portion of the vinyl resin they obtained for that same period in 1950, which is not nearly enough to fill their demand for hose. But during the rest of the year they may obtain more vinyl resin than they need. They can't afford, or haven't the facilities, to carry the large inventory that would be required to handle this sort of situation, and consequently, are running far under demand.

No one seems to have an answer to this problem, and producers assert that this allocation by historical purchase record is the fairest method they have been able to work out. The only other method that seems adaptable would be for the government itself to assume allocation duties, and no one in government wants to take over the responsibility of determining the essentiality of all the civilian products made from styrene and vinyl. Government officials feel that raw material producers themselves are far more capable of directing the course of the industry and planning its future than is Washington.

Colored Labels

INFORMATIVE labeling has been given a new twist by Krieger Color & Chemical Co., Inc., 6531 Santa Monica Blvd., Los Angeles 38, Calif., to identify its line of Poly-Supra colors for plastic molding powders. The label on each container is printed on one of four differently colored backgrounds—red, yellow, green, and blue—which corresponds to the main basic color of the colorant contained in the can.

The Poly-Supra line includes 17 standard colors and over 1500 colors in metallics, fluorescent, phosphorescent, and other groups.

Expansion Delays

THE government's delay in granting certificates of necessity and the possible danger inherent in a price rollback of such basic chemicals as chlorine, acetylene, sulfuric acid, and so forth, may prove very costly to the country's economy and national security, according to John R. Hoover, vice president in charge of sales for B. F. Goodrich Chemical Co.

He explains that the government should take a more realistic attitude in granting certificates of necessity to chemicals that are needed in the present emergency. The adoption of a tough attitude by government in granting these certificates, which permit tax amortization over a period of five years, could prove to be the greatest deterrent to private industry in making additions to its present productive capacity, says Mr. Hoover.

He also states that construction of plant facilities cost several times more than comparable expansion in 1940-1945. Further, with the rapid pace of vinyl resin technology, in which his own company is particularly interested, it is likely that these facilities will be largely obsolete in five years.

In pointing out the danger of price rollbacks for basic chemical producers, Mr. Hoover says that expansion of these basic raw materials requires a tremendous capital outlay with great risk, and if adequate returns are not anticipated, companies simply will not expand.

States Mr. Hoover: "It is necessary that private industry be encouraged by government to provide the additional plant facilities needed. In a normal period industry can evaluate its market potential and predetermine to a great extent the risks involved in expansion. But in this period of mobilization and superboom the market pulse cannot be accurately felt and consequently there is hesitation in making gigantic capital outlays for new facilities without commensurate incentives."

Of the vinyl resin supply situation, he says that despite a temporary softening of the consumer goods market affecting vinyl film and sheeting sales, vinyl sales of resin still exceed supply by a wide margin. "If the seasonal peak in film and sheeting occurs in the fall as anticipated, the situation will be still further aggravated. Government needs for resins are steadily increasing, particularly in wire, cable, and coated fabrics, and the possibility of government allocation of the basic chemicals still exists."

S.P.E. Prize Paper Contest

THE Annual Prize Paper Contest, sponsored by the Society of Plastics Engineers, Inc., will be awarded in January 1952 at the Annual Technical Conference of S.P.E. Papers are solicited from members and non-members of the Society, and may deal with any phase of the plastics business, such as molding procedures, mold design, product design, machine design, extrusion, laminating, calendering, coating, films, packaging, test procedures, materials properties, chemistry, en-

gineering design, personnel selection, sales technique, and so forth. Articles may be of any length; the only requirement is that the article be pertinent to some phase of the plastics business.

Deadline for the papers is Oct. 1, 1951, by which time five copies of each article submitted should be in the hands of the Prize Paper Committee Chairman, Rudolph Theumler, Reichhold Chemicals, Inc., Ferndale, Mich. Awards are: first prize, $200; second, $100; third, $50.

Plastic to Metal Bonding

RECOMMENDED particularly for the bonding of rubber or plastics to a metal surface, Ardux 120 adhesive has been put on the market by Ciba Co., Inc., 627 Greenwich St., New York 14, N.Y. The company claims that when Ardux 120 is used, it is not necessary to employ the time-consuming pre-processing of aluminum and magnesium surfaces which has heretofore been required in order to obtain a satisfactory bond. The adhesive is recommended for bonding plastics and rubber to metals and for bonding rubber and plastics together.

Solvent

AVAILABILITY of a new solvent material, called Soludiene, has been announced by Colonial Alloys Co., Ridge and W. Crawford Sts., Philadelphia 29, Pa. The product can be used alone or in combination with other solvents, and is reported to be particularly applicable for use in formulating surface coatings, organosols, inks, waxes, etc. The composition is approximately 65% paraffines, 20% naphthenes, and 15% aromatics. It has a specific gravity at 60° F. of 0.753; A. P. I. gravity at 60° F. of 56.5; flash point, T.CC° F. of 83; and viscosity, Centistokes at 77° F. of 0.86. Samples can be obtained for testing.

Silicone Plant Capacity Tripled

FACILITIES for molding and extruding silicone rubber parts have been transferred from General Electric's Pittsfield, Mass., plant to Decatur, Ill., where new equipment has been installed that will triple production and permit the manufacture of larger size parts than have been formerly available from the company.

The increased production facilities were installed to handle the increasing number of applications in non-defense as well as defense jobs. It is expected that large quantities of molded and extruded silicone rubber parts will be used in the near future for hermetically sealed electrical components, for ignition and transmission systems on tanks, and for gaskets, ducts, and cable for the aircraft industry.

Formaldehyde-Urea Resin Plant

PLANS to construct a formaldehyde and liquid urea resin manufacturing plant on the outskirts of Demopolis, Ala., have been announced by the Chemical Div., The Borden Co. The new unit, which is scheduled for completion in the beginning of 1951, will be geared to produce about 1.5 million lb. of formaldehyde and 2 million lb. of liquid urea resin per month during the first year of operation. This is the first plant in the Southeast to produce formaldehyde, and will also be a feeder plant for the company's Kernersville, N. C., plant which manufactures liquid urea resin for the Southern furniture industry.

Modeling Material for Mock-ups

AVAILABILITY of Closeal, a new putty-like molding material for the plastics industry, to be used in producing mock-up and prototype parts and assemblies, has been announced by Industrial Products Div., Clopay Corp., Cincinnati 14, Ohio. The material can be molded by hand to form any desired shape, after which it can be baked at temperatures around 350° F. to produce a model in permanent form.

Anti-Static Agents

SIZABLE quantities of Anstac M, a new anti-static and cleaning agent developed specifically for methyl methacrylate, are being manufactured by Chemical Development Corp., Danvers, Mass. This [illegible] static agents developed by [illegible] for the plastics industry.

Additional production facilities recently installed at Roxbury Chemical Works, Inc., Centredale, R. I., have made possible a 10% price reduction in the cost of D-Stat B, a liquid anti-static agent for styrene. The company claims that styrene articles, such as radio and television cabinets, refrigerator parts, industrial components, etc., stay static-free after repeated wipings when treated with D-Stat B.

Junior Achievement Award

ON May 9, 1951, the Third Junior Achievement Plastics Product Award was completed at the organization's headquarters in New York. The judges were the same this year as last: chairman, James F. O'Bryan, Bakelite Co.; S. Jack Helsper, Mack Molding Co.; and Todd Harris, Creative Plastics Corp.

FINANCIAL

Lionel Corp. reports net profit for year ending Feb. 28, 1951, at $2,263,534 compared with $1,650,322 in the previous fiscal year. Net sales were $21,541,875 compared to 1950's volume of over $15,280,777. Optimistic expectations for Lionel's recent acquisition of substantial interests in Universal Aviation Corp. were also stated. Universal is a specialist in production of aviation equipment including a plastic panel board lighted by a new technique which was described recently in this column.

The Hydraulic Press Mfg. Co. reports net profit in the first quarter, 1951, of $95,575 against $50,830 a year ago.

Celanese Corp. of America reported net income before federal income taxes of $20,238,196 for the first quarter of 1951, compared with $17,187,886 for the same quarter in 1950. Increased taxes outstripped increase in profits, and the net income after taxes was $8,285,196 for the first quarter, compared with $9,856,886 for the same period in 1950. Sales for the 1951 quarter were $63,537,932, which were $10,315,330 above the sales of the corresponding quarter last year.

United States Plywood Corp. reported record consolidated sales of

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If ever-r-r things go wrong, ring our gong!

Santicizer 140, 141, 160, and other plasticizers have done such good work for you that you want more of them than we can make... even though we're doing all we can to expand production.

It will be a happy day for us when we're again ringing *your* bell and asking for orders. In the meantime, ring *our* gong whenever we can be of service to you. We promise our best efforts. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri.

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$103,545,000 for the fiscal year ending April 30, 1951, which were 57% greater than the $69,235,000 sales of the preceding fiscal year. Sales for the final quarter were $29,980,000 compared with $19,823,000 for the same quarter of 1950.

COMPANY NOTES

Ideal Plastics Corp., 184-10 Jamaica Ave., Hollis, L. I., N. Y., has announced the election of **A. M. Katz** as chairman of the board, and the promotion of **Alfred C. Manovill** to vice president and general manager. Coincident with these announcements, plans were revealed for a plant expansion program involving the addition of heavy injection molding machinery to existing production equipment.

KATZ MANOVILL

Mr. Katz is a veteran designer and production manager in the plastics industry, and has been with Ideal for 40 years. He is also treasurer and general manager of Ideal Toy Corp.

Mr. Manovill has been a leading figure in the plastics field since 1924, and has been with Ideal since 1945.

Ideal also announces that **M. Larry Kaufmann** and **Max Lidz** have been appointed to the company's custom molding sales staff, serving the metropolitan and suburban New York areas.

Monsanto Chemical Co. has announced the formation of a new subsidiary company in Sao Paulo, Brazil, **Monsanto S. A. Produtos Quimicos e Plasticos**, for the manufacture of vinyl chloride monomer and Ultron polyvinyl chloride resins and compounds. Production units of the new company, the first to produce vinyl chloride in Brazil, are expected to be operating by the end of 1952.

Michigan Oven Co., 4544 Grand River Ave., Detroit 8, Mich., manufacturer of industrial ovens, has announced the election of **A. C. Towne, Jr.**, as president of the firm. Mr. Towne has appointed **William Jarvis** as general manager.

Paper Machinery & Research, Inc., 1014 Oak St., Roselle, N. J., has acquired larger facilities for the production of engraved applicator rolls for applying plastics, adhesives, and color in liquid form.

Synvar Corp., has started operations in its Greensboro, N. C., plant under the name Synvar Southern Corp., which will produce urea-formaldehyde, phenol-formaldehyde, and resorcinol-formaldehyde type resins for the manufacture of plywood and furniture.

The Dow Chemical Co. will spend over $100 million for expansion during the fiscal year beginning June 1, 1951, it was announced in Freeport, Texas, by **Leland I. Doan**, president. Half of the amount will be spent at the Freeport site. The present program is being financed by Dow's private capital, but progress in building will depend upon government authorization of priorities for construction materials.

Thermold Corp., injection molder, has moved from Clinton to Manlius, N. Y. where it can serve its New York City and Buffalo customers more easily.

Clopay Corp. has announced the following additions to the laboratory staff: **S. G. Lewis; P. N. Valerius; H. W. Gear; L. Charkins;** and **E. H. Libby. W. Tallentire** has joined the laboratory engineering development staff, and **D. Weber** is in charge of the extrusion operation at the Elmwood Place, Ohio, plant.

Bakelite Co. has appointed **Victor H. Turkington** director of research, and **Leonard Connor** retail sales promotion manager.

General Electric Co.'s Chemical Dept. announces the following personnel changes: **G. Arthur Gustafson** has been appointed manufacturing and materials engineer of the plastics division; **James Wilson** has been named supervisor of the Taunton, Mass., plant; and **E. E. Hinson** has become sales representative in Washington, D. C.

Rogers Corp. announces three personnel appointments: **Austin R. Schillinger** has been named purchasing agent; and **Mary B. Mullaney** and **Stark B. Ferriss** have been made sales coordinators at Manchester and Goodyear, Conn., respectively.

Paterson Plastics & Chemical Co. has issued a license to **Amyx Mfg. Co.** to manufacture the Xylite line of thermosetting plastic molding compounds.

Santa Anita Companies, Inc., has recently been formed by the merger of **Juel Corp.**, Arcadia, Calif., producer of laminates and plastic lenses, and **Calresin Corp.**, with base resin and coating plants in Culver City, Calif., which will produce industrial coatings and elastomeric hot melt materials in the Arcadia plant. **Kenneth C. Kingsley**, heads the new firm and will continue as president of Juel; **William Lockwood**, president of Calresin, is vice president in charge of research for the new corporation.

Atlas Powder Co. has announced that **Kenneth E. Mulford** has been named general manager of the **Industrial Chemicals Dept.**, succeeding **J. R. Frorer** who was elected a vice president. **J. Peter Kass** was appointed director of the **Research and Development Dept.**, replacing **K. R. Brown** who was also elected a vice president.

Delaware Floor Products, Inc., Wilmington, Del., has sold its assets, manufacturing rights, and facilities to **Congoleum-Nairn, Inc.**, which will continue to operate the Wilmington plant and market Delaware's Flor-Ever vinyl flooring. In addition, Congoleum is planning to add vinyl products to its own line of linoleum and enamel surface floor and wall coverings.

Union Carbide and Carbon Corp. announces that **Fred H. Haggerson**, president, has been elected chairman of the board of directors; **Morse G.**

PLASTISCOPE

Dial has been named executive vice president; and **Dr. George O. Curme, Jr.**, has been elected vice president in charge of research.

Owens-Corning Fiberglas Corp. has announced that **Reinforced Plastics** sales headquarters has moved from Toledo, Ohio, to the Fiberglas Building, 16 E. 56th St., New York, N. Y., where sales activities will be headed by **Ralph Perkins, Jr.**, plastics sales manager.

A. Bamberger Corp., reprocessor of plastics scrap, has recently moved to its new 150,000 sq. ft. plant at 703 Bedford Ave., Brooklyn, N. Y., where new equipment has been installed to reduce large blocks or lumps of plastics and scrap to small particle size.

Rona Laboratories, Inc., announces volume production of synthetic and natural pearl essence at its new plant at 352 Doremus Ave., Newark, N. J.

Hercules Powder Co. has announced that **Robert Wier III** and **Emerson L. Morris** have joined the **Purchasing Dept.**, while **Kurt H. C. Holzheuer** and **Paul C. W. deJong** have been named assistant directors of **N. V. Hercules Powder Co.**, The Hague, Holland. **Leland H. Burt** has been named supervisor of **Product Development** for the **Cellulose Products Department.**

PERSONAL

Clement A. Damen has been appointed manager of **Witco Chemical Co.'s** Washington, D. C. office, 1111 17th St., N. W.

Dr. O. R. Brunkow, formerly with Commercial Solvents Corp., has been named sales manager for **Hardesty Chemical Co.**, manufacturer of plasticizers and sebacic acid.

Joseph S. Hawkins, formerly sales manager of the **Coating, Labeling, and Latex Cementing Div.** of **Potdevin Machine Co.**, has been appointed general manager of that department.

Jean O. Reinecke, head of **Reinecke & Associates** and chairman of the Society of Industrial Designers, has been named to the board of consultants of **Color Analysis & Design Evaluation, Inc.**

John J. Ryan has been transferred to the sales force of the newly formed **Pacific Div., Nopco Chemical Co.**

George L. Innes has been promoted to assistant sales manager for **Jefferson Chemical Co., Inc.**

Willard deCamp Crater, formerly with **Glenn L. Martin Co.**, has been appointed assistant sales manager of Marvinol resins for **Naugatuck Div., United States Rubber Co.**, where he will develop new markets for vinyl resins and direct sales activities.

John H. Moore, sales manager of **Prolon Plastics Div.**, has been elected a vice president of **Pro-phy-lac-tic Brush Co.**, Florence, Mass.

T. N. Lind, Jr., has been named sales manager for **Lind Plastic Products, Inc.**, 4451 W. Rice St., Chicago, Ill.

Murray J. Beck has been elected vice president in charge of sales for **Leaf Plastics, Inc.**, Yonkers, N. Y.

O. Wendell Macy, formerly with Logansport Machine Co., Inc., has been appointed sales manager of **Hydraulic Power Div., The Hydraulic Press Mfg. Co.**, Mt. Gilead, Ohio.

Albert B. Diss has been named manager of manufacturing operations for **The Watson-Stillman Co.**

Frederick W. Dover has been named manager of plastics operations for **A. Schulman, Inc.**, where he will be in charge of buying, selling, and processing of virgin plastics and reground molding compounds.

Warren A. Beman, staff member in charge of textile work for the chemical products division of **Socony-Vacuum Oil Co., Inc.**, has been appointed to direct chemical products development for the company.

Edward F. Krieger has been elected vice president in charge of manufacturing for **The Bolta Co.** and **Bolta Products, Inc.**, of Lawrence, Mass. Mr. Krieger was formerly production manager of The Bolta Co. and has been with the firm since its beginning in 1931.

Francis J. Curtis has been named assistant administrator to head the **Chemical, Rubber and Forest Products Bureau** of **National Production Authority.** He is on leave as vice president of **Monsanto Chemical Co.**

John Corwin, Koppers Co., Inc., who served with the OPA during the last war, has recently joined the **OPS** staff in Washington where he will concern himself with pricing regulations as they affect plastic raw materials and molding compounds.

Dr. Granville A. Perkins, who has been with the company since 1929, has been appointed vice-president in charge of research for **Carbide and Carbon Chemicals Co.**, and is in charge of research laboratories at South Charleston, W. Va., where basic research and development work is being done on synthetic organic chemicals, plastics, and synthetic fibers.

Alfred J. Oxenham has been appointed technical representative in the **Product Development Dept., Pittsburgh Coke & Chemical Co.** He was formerly with Monsanto Chemical Co.

Deceased

Robert L. Richmond, vice president and general manager of the **Coating Div., Potdevin Machine Co.**, died at the age of 38.

David C. Scott, president of **Scott Testers, Inc.**, died in Providence, R. I., May 12. He was a member of the American Society for Testing Materials, American Chemical Society, and the American Society of Mechanical Engineers.

MEETINGS

Sept. 3-13—World Chemical Conclave: the 75th anniversary of the American Chemical Society; 16th Conference of the International Union of Pure and Applied Chemistry; and the 12th International Congress of Pure and Applied Chemistry. Statler Hotel, New York, N. Y.

Sept. 6-19—American Institute of Chemical Engineers, National Meeting, Sheraton Hotel, Rochester, N. Y.

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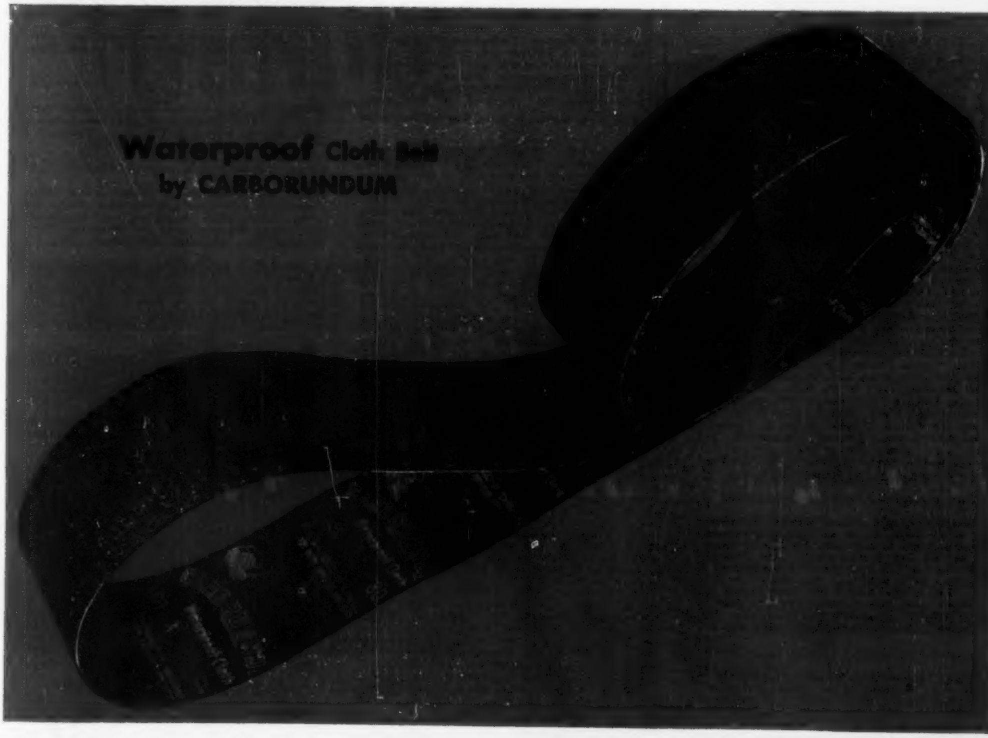

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FOR SALE: 50 Ton Stokes Presses & Pump. 300 Ton W.S. Hobbing PRESS, 300 Ton W.S. PRESS 30 x 20 Platen, 175 Ton H.P.M. PRESS 30 x 30 Platen, 150 Ton Farrel PRESS 30 x 30 Elec. Platen. 140 Ton W.S. PRESS 23 x 17 Platens. 85 Ton Stewart Bolling PRESS 20 x 20 Platen, 50 Ton Elmes PRESS with 18 x 18 Elec. Platen, 75 Ton W.S. PRESS 15 x 15 Platen, 75 Ton Adamson PRESS 20 x 20 Platens. Laboratory presses, Accumulators, Piston and Oil Pumps. AARON MACHINERY CO., INC. 45 Crosby St., N.Y.C.

FOR SALE: Thermex Preheater, Model 2P; Airtronics Preheater, Model D E; Airtronics Preheater, Model C B. Like new. AARON MACHINERY CO., INC. WOrth 4-8233, 45 Crosby St., New York 12, N. Y.

FOR SALE: 1—Farrel Birmingham 22 x 60" Plastics Mill, latest type with 125 H.P. Motor and Drive; 1—French Oil Mill 300 ton self contained molding press with pushbacks; 1—125 ton Molding Press, 18" x 18". Also Grinders, Extruders, Compression and Injection Molding Presses, Mixers, etc. Send us your inquiries. Consolidated Products Co. 13-14 Park Row, New York 38, New York.

FOR SALE: Quick delivery Rubber and Plastic Equipment. Farrel 18" x 48", 16" x 40", and 15" x 36", 2 roll rubber mills. New 6" x 12" Lab. Mixing Mills and Calenders. Other sizes 30" to 60". Royle #2 perfected extruder, and other sizes. 180 ton F. B. Molding Press 20" x 20". Francis 175 tons 24" x 18". W.S. 115 ton 24" x 24". Also presses Lab. to 1500 tons from 12" x 12" to 48" x 48". Hydr. Oil Pumps. Watson Stillman Hor 4 plgr. 1-1/4" and 2½" x 4" H & L pressure pump. HPM 10 GPM 2700 lbs. Elmes Hor. 4 plgr. 5 and 8 GPM 4500 lbs. and 5500 lbs. Hydr. Accumulators. Stokes Automatic Molding Presses. Stokes R & Colton 4T Preform Tablet Machines. Also Rotary & Single Punch Tablet Machines ½" to 3". Injection Molding Machines 2 oz. to 20 oz. Baker Perkins jacketed mixers 200 and 9 gal. Impregnating units. Leominster #0 Plastic Grinder, Mikro Pulverizers. Heavy duty mixers, grinders, pulverizers, gas boilers, etc. Partial listing. We buy your surplus machinery. Stein Equipment Co., 90 West St., New York 6, N. Y. WOrth 2-5745.

We handle hydraulic presses, pumps, and power units of all sizes. Write us your requirements and we will try to help you. We find it impossible to list our equipment in this classified column due to the fact that the equipment is sold before ad is published. For those who seek action look in the New York Times under the Machinery and Tool Column for our regular Sunday Special. Hydraulic Sal-Press, Inc., 386-90 Warren Street, Brooklyn 2, N.Y. MAin 4-7847

FOR SALE: Injection Presses: 4, 16 & 40 oz HPM. 16 oz Watson. 22 oz Lester. Extruders: NRM Lab. 1¼", 2½" NRM w. crosshead. Scrapgrinders. Despatch Ovens. Several Mold Temp. controls. 2—Leiske Plasti-Dryers. 4—Miskella Infrared Dryers. Compression Presses: 80,250 tons. 1—600 ton downstroke. 2—Stokes Automatic (12 & 15 tons). Terkelsen mechanicals: 5—50 tons, 2—100 tons. Various hydraul. pumps. Preformpresses: 1—Kux No. 60, 1—Colton 3E, 1—Kux AS Rotary. 1—Nash Rotary Edger. 2—3HP Gasboiler. 1—42" Johnstone Slitting & Rewind. machine. 1—51" Sheet Die, Takeup & Cooling unit for 2½" NRM Extruder. 1—Dipping & Drying unit for liquid Vinyls. Justin Zenner, 523 W. Waveland Ave., Chicago 13, Ill.

FOR SALE: Livingstone Speedylectric Boiler, 500-3. Never used. 100 lb., 3 HP, operates at maximum rating on any voltage from 208 to 600. We moved to location already equipped with steam. Reply Box 988, Modern Plastics.

FOR SALE: 1—22 oz. Reed-Prentice (47); 1—22 oz. Impco, Vert. (47); 1—16 oz. Impco, Vert. (47); 1—8 oz. Leominster (47); 2—6 oz. Lesters (1942); 1—6 oz. Watson Stillman (1944); 1—4 oz. Lester, Vert. (1946); 1—2 oz. DeMattia Vert. (1942); 1—1 oz. Van Dorn (Hand Feed) New. Reply to R. A. Peterson & Co., P. O. Box 305, Springfield, Mass.

AT GREATLY REDUCED PRICES
Colton 2 and 3 RP Rotary Tablet Machines. Mikro 1SH, 2TH & 4TH Pulverizers; Jay Bee, Schutz-O'Neill Mills. Baker Perkins & Readco Heavy Duty Steam Jacketed, Double Arm, 50, 100, 150 gal. Mixers. Baker Perkins 150 gal. D.A. Unidor Jacketed Mixer. Baker Perkins 100 gal. D. A. Vacuum Mixers. J. H. Day 75 & 35 gal. Imperial & Cincinnatus D. A. Jacketed, Sigma Blade Mixers. Day and Ross Pony Mixers—8, 15, 40 gal. caps. Hobart & Read Vertical Mixers, from 15 to 120 quart, with removable bowls. Day & Robinson 100 up to 4000 lbs. Dry Powder Mixers. Package Machy. FA, Miller, Hayssen 3-7 Auto. Cellophane Wrappers. This is only a partial list. Over 5000 machines in stock—rebuilt and guaranteed—available for immediate delivery. UNION STANDARD EQUIPMENT CO., 318-322 Lafayette Street, New York 12, N. Y.

SAVE WITH GUARANTEED REBUILT EQUIPMENT — HYDRAULIC PRESSES, 24" x 24", 18" ram 318 tons; 24" x 56", 450 ton multiple opening; 24" x 24", 16" ram, 250 tons; 24" x 24", 12" ram, 170 tons; 24" x 42", 2—12" rams, 340 tons, 42" x 42", 16" ram, 250 tons; 36" x 36", 12" ram, 141 tons; 20" x 18", 10" ram 118 tons; 20" x 20", 10" ram, 118 tons; 19" x 24", 10" ram, 78 tons; 22' x 15', 8' ram, 75 tons; 27" x 21", 8" ram, 75 tons; 15" x 15", 8" ram, 75 tons; 12" x 12" 7½" ram, 60 tons; 12" x 12", 6½" ram, 50 tons; 8" x 9½", 4½" ram, 20 tons; 16" x 16", 3½' ram, 12 tons; Laboratory Presses; 10 ton Carver 6" x 6", Watson Stillman 30 ton, 6" x 6"; Laboratory Millsand Calenders (NEW) M. D.; THROPP Mill 16" x 40" M. D.; NEW DUAL PUMPING UNITS, all sizes; Extruders; Royle Rubber #2, Royle Plastic #1, PREFORM PRESSES, Stokes T, Colton, 5½ T and Stokes DDS4 with Reeves Drives, also Mixers, Vulcanizers, Accumulators, etc. Universal Hydraulic Machinery Company, 285 Hudson Street, New York City 13, N. Y.

INJECTION MOLDING MACHINES
4-Oz. H.P.M. late, excellent............Offers
4-Oz. REED Mod 5A, new '50, excel....Offers
6-Oz. WATSON STILLMAN, new '42.. 5,950.
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9-Oz. H.P.M. Mod. 200H9, new '40....... 6,000.
16-Oz. REED, new '46 complete........ Offers
16-Oz. LESTER, new '46, excel.......... Offers
22-Oz. LESTER, Rebit, new '44, Mod. L-3 17,500.
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32-Oz.& 48-80-Oz. IMPCO, also others avail.
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450 T. H.P.M. new '46, w/turbo, excel. Offers
350 T. SOUTHWARK, 18" St. 24x24" pl. 2,975.
350 T. H.P.M. Self-Cont. new '46.........12,500.
200 T. FARREL 14" ram, 24x24" pl..... 1,750.
170 T. BURROUGHS Trans., 14" St. (2) 1,850.
100 T. LAPOINTE, Self-Cont. 13" St... 1,950.
75 T. STANDARD, '40, Vert. & Horiz. 1,975.
50 T. WS & JOHNSON, others avail. 650. up
BALL & JEWEL Gr. #2½, 75 HP, com. 3,000.
MISCELLANEOUS & PUMPS
ELMES HYD. PUMPS w/ACCUMULATOR
240 GPM, 1500-2500# p.s.i. .... Offers
WILSON SNYDER Hyd. Pump, 25 GPM, compl. .... 6,000.
VICKERS Hyd. Pump, Mod. V135, 17 GPM 750.
B&S Gear Pump & Allis 5 HP 1000#p.s.i. 200.
NAT'L Accumulator Pressure Vessels.... 900.
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PHENOLIC POWDER PLANT, 200,000# per mo. .... Offers
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STOKES, Mod. DD2, 23 Stat. rotary, 1¼"x2" ....5,500.
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SCHUTZ-O'NEIL Pulverizer, 20 HP, #D 950.
EVEREADY CO. E. J. McCallum, Prop.
805 Housatonic Ave. 4-9471 Bridgeport, Conn.

FOR SALE: Injection Molding Machine. 6-Oz. Hydraulic. Complete with controls. Perfect Condition. Reply Box 987, Modern Plastics.

FOR SALE: 1—16" x 42" Mill; heavy duty; 50 HP/AC Motor; enclosed reduction drive; Designed for phenolic compound. Manufacturers Supply Co., 185 Church St., New Haven, Conn.

MACHINERY and EQUIPMENT WANTED

MOLD WANTED for injection molding. We will buy one mold or a complete line or series of molds for finished resalable items. Housewares, toys, novelties, etc. Will also buy molds for industrial parts such as handles, knobs, drawer pulls, gears. All items for resale in U. S. A. Send detailed information to Victory Manufacturing Company, 1722 W. Arcade Place, Chicago 12, Illinois.

WANTED: Immediately—HPM Injection Molding Machines. Kindly send complete information together with prices to R. A. Peterson & Co., P. O. Box 305, Springfield, Mass.

WANTED: Four ounce Model 10-A-4 Reed-Prentice injection molding machine. Prefer late model. Quote price, condition, year purchased, and where machine may be examined. Perry Plastics, Inc., 561 East 18th Street, Erie, Pa.

Plastics granulator wanted, heavy duty, large capacity, must be in good condition. Reply Box 1101, Modern Plastics.

WANTED: No. ½ Cumberland Grinder. Details and price to Box 1105, Modern Plastics.

WANTED: Several automatic machines for drilling complete holes in Melamine Buttons. Reply Box 1107, Modern Plastics.

WANTED: 4 to 8 opening laminating hydraulic press approximately 38"x74" or larger. Must be equipped for steam heating and water cooling. Must have hydraulic pumps and all necessary controls. State age, condition, price, and location. Also, state when available. Reply Box 1108, Modern Plastics.

MACHINERY WANTED—Low pressure hydraulic weighted accumulator; stroke, 8 or 10"; ram, 12 or 14". Must be in first class working condition. Plastics Products, Inc., Pine Street, South Norwalk, Conn.

WANTED: One sixteen ounce or twenty-four ounce Reed-Prentice injection molding machine in good working condition, contact Bernard Edward Co., Canada, Ltd. 350 Wallace Avenue, Toronto, Ont.

MATERIALS FOR SALE

OFFERING: Almost all types of virgin vinyl resins, polyethylene, polystyrene, cellulose acetate, plasticizers, and associated chemicals. K. M. AARON CO., INC. 7 Brown St., Newark 5, N. J., Market 3-5908.

(Continued on page 196)

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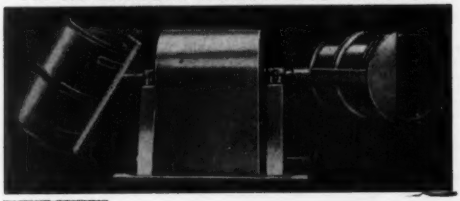

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CLASSIFIED ADVERTISING

(Continued from page 194)

OFFER: 30,000 lbs. per month Polystyrene Gates, Sprues and Runners. All Dow and Monsanto. Reply Box 989, Modern Plastics.

FOR SALE: 50,000 lbs. Crystal Clear Cellulose Acetate Sheet Scrap. Reply Box 992, Modern Plastics.

FOR SALE: 350 sheets of Celanese Corp. Lumarith Plastic. Cerise color. Polished sheets 21x50". Make Offer. Satone Corporation, 1000-08 Towne Avenue, Los Angeles 21, Calif.

FOR SALE: Reground and Reprocessed Cellulose Acetate, Ethyl Cellulose, Butyrate powder in assorted colors at reasonable prices. Let us know your specific requirements and we will make appropriate offers.
Claude P. Bamberger, Inc., 228 Wooster Street, New York 12, New York.

FOR SALE: 6500 lbs. reprocessed black vinyl 80 to 90 durometer 43¢ lb. F.O.B. Detroit Ideal Models Co., 17255 Moran, Detroit, Michigan

LUCITE—PLEXIGLAS GLACITE SHEETS—RODS. Always in stock.—We deliver. PLASTIC GLASS CORP. 33 Ave. P., Newark 5, N. J. MU 7-6477

FOR SALE: Laminated sheet plastic (Marcolite & U.S.V. Board) between 1/16" & 3/32" thick, tan colors. Surplus job lot for sale. Free sample piece. Write to Sterling, 511 N. Ashland Avenue, Chicago 22, Illinois. Phone TA 9-5232

OFFER 50,000 lbs. or more per month clean sorted vinyl scrap. Suitable extruding or calendering. Price secondary to permanent working arrangement with reliable consumer. Reply Box 1103, Modern Plastics.

MATERIALS WANTED

WANTED: PLASTIC Scrap or Rejects in any form. Acetate Butyrate, Polystyrene, Acrylic, Vinyl Polyethylene, etc. Also wanted surplus lots of phenolic and urea molding materials. Custom grinding, magnetizing and compounding. Reply Box 978, Modern Plastics.

WANTED: PLASTIC SCRAP or REJECTS in any form: Cellulose Acetate, Butyrate, Polyethylene, Polystyrene, Vinyl, Acrylic and Ethyl Cellulose. Reply Box 979, Modern Plastics.

WANTED: Surplus virgin polyethylene, polystyrene, crystal cellulose acetate, tenite I & II, vinyl resins, dioctyl phthalate, titanium dioxide. We also purchase all forms of thermoplastic scrap and rejects. Offer top prices, cash in advance if necessary. K. M. AARON CO., INC. 7 Brown St., Newark 5, N. J. Market 3-5907

WANTED: Ethocel, Butyrate, and Polystyrene material—virgin, regrind, and scrap parts. Reply Box 980, Modern Plastics.

WANTED: Plastic Scrap or Virgin. Also Acrylics, Polystyrene, Polyethelene, Vinyl, Cellulose Acetate. Your inquiry solicited to buy or sell. GEORGE WOLOCH CO., 61 Broadway, New York. Phone HAnover 2-1173.

WANTED: Plastic Scrap, Rigid Vinyl, Cellulose Acetate, Polystyrene, Polyethylene, Butyrate. Custom grinding, magnetizing, compounding, and straining of contaminated plastics. Franklin Jeffrey Corporation, 1671 McDonald Avenue, Brooklyn, N. Y. ES 5-7943.

WANTED: Rigid Vinyl scrap in any form. Will purchase accumulations on contract basis if desirable as we are steady users. Reply Box 991, Modern Plastics.

WANTED: Vinyl scrap rigid, preferably ground, steady outlet. Marco Products, Inc., Box 605 Clifton Heights, Pa. Madison 3-7457

MOLDS WANTED

USED MOLD wanted to produce wine bottle closures; suitable for small compression press. Reply Box 984, Modern Plastics.

WANTED: Used Molds for the manufacture of combs in attractive styles, all types and sizes. Also wanted mold for light part-ware spoons and forks suitable for 4 oz. machine. Reply Box 985, Modern Plastics.

FOREIGN manufacturer seeks compression button molds of all kinds. Especially 12 and 20 ligne ring fisheye and 24 and 34 ligne suiting buttons. Also compression molds for other items or novelties. Is interested in royalty or partnership arrangements aside from outright purchase. Reply Box 999, Modern Plastics.

HELP WANTED

CHEMIST familiar with Vinyl dispersions, plastisols and organisols. We are an old, established firm in Newark, N. J. Position open requires primarily fundamental knowledge in the field of Vinyl dispersions with particular emphasis on slush molding. Also injection molding. Give details of education, experience and salary requirements. Excellent opportunity for right man. Our organization knows of this ad. Reply Box 995, Modern Plastics.

WANTED: Thoroughly experienced man, chemical engineer preferred, with complete knowledge of all phases of the manufacture of high pressure decorative and industrial laminates. Must know how to make and test laminates and solve all chemical difficulties which may arise. Reply Box 1110, Modern Plastics.

PRODUCTION AND DEVELOPMENT: A Chemist or Chemical Engineer familiar with laminating operations, pressure-sensitive tape production, and adhesives for such applications. Progressive New England firm. A letter with full details is requested. Reply 1112, Modern Plastics.

PLASTICS MOLDING ENGINEER
Established and progressive New Jersey manufacturer needs an engineer experienced in plastic molding and mold design. Must be capable of carrying a complete project through estimating, designing, material selection and production. Opportunity for development and research. Compression and transfer molding at present, with possibilities of enlarging to injection molding. Wide range of plastics operations. Excellent opportunity for the man of ability and ingenuity. Reply giving details of education, experience, past earnings, and salary requirements. Include photo. Apply Box 1104, Modern Plastics.

GENERAL FOREMAN: Must have extensive experience in Injection Molding Processes and Molding of large methacrylate and styrene parts, up to 60 oz. Working knowledge of mold design. Take charge of three shift operation and supervision of shift foremen. Salary commensurate with ability. Located in Middle West. Reply Box 996, Modern Plastics.

Injection molding sales agents wanted by progressive molder located in New York City with injection capacity of nine to sixty ounces. Have own tool shop and excellent material sources. All territories outside of Metropolitan New York open. Protected territory at regular commission of 5% on net sales. Can offer utmost in cooperation. Please send full details. Confidential. Our employees know about this advertisement. Reply 1109, Modern Plastics.

CHEMIST OR CHEMICAL ENGINEER — A small laminating firm entering plastisol and organisol film casting business, needs chemist or chemical engineer who has had experience with adhesives and plastics to take full charge of the laboratory. The company is located close to large mid-western city, and presently employs about 100. When applying, give explicit details as to age, previous experience, education and salary expected. Reply Box 998, Modern Plastics.

WANTED: Graduate engineer with approximately five years experience in testing or application of plastic materials, primarily thermosetting and thermoplastic molding materials and laminates, having a good knowledge of their physical properties. Position in Plastics Laboratory of large New York State manufacturer of precision electro-mechanical devices. Send full details of education and industrial experience. Reply Box 983, Modern Plastics.

COATER FOREMAN OR ENGINEER —To take charge of new coating unit being established in Pennsylvania. Must be experienced with organisols and plastisols. Submit detailed resume of background and experience with first letter. Reply Box 981, Modern Plastics.

Large Midwestern Proprietory Molder needs two men for expanding compression and inspection molding operations:

First opening requires man with experience and ability in mold design, material specification, estimating mold and piece price, complete familiarity with materials, machines, molding techniques and finishing operations for present day plastic materials: Ability to supervise and head up department doing this work with experience in customer contact desirable. Salary depends upon experience and ability.

We have an opening also for experienced mold and molding technician: Man we need must be capable of taking new mold and working up standard operating cycles completely with a minimum of supervision. Thorough knowledge of materials and molding techniques necessary. Time study experience and knowledge of inspection methods desirable.

Send complete details and work record with first application. Reply Box 1102, Modern Plastics.

FIVE YEARS HENCE—Where will you be five years from now?
We have a position that offers permanency and future opportunity for a mechanical engineer who desires to enter the plastic industry and train for sales engineering.
Ours is a successful, growing corporation of moderate size, in the chemical and plastics industry.
For interview appointment write giving full details to: Frank Rogers, Box 986, Modern Plastics.

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All classified advertisements payable in advance of publication

Up to 60 words $7.50	Up to 120 words $15.00	Up to 180 words $22.50
Up to 60 words (boxed) ... $15.00	Up to 120 words (boxed) ... $30.00	Up to 180 words (boxed) ... $45.00

For further information address Classified Advertising Department, Modern Plastics, 575 Madison Avenue, N. Y. 22, N. Y.

CLASSIFIED ADVERTISING

(Continued from page 196)

EXPERIENCED PLANT MANAGER—Thermosetting plastics plant, employing between 200 and 300 persons. Must be capable of supervision of resin impregnating of paper, textiles, etc.; production of products with compression molds; finishing of products; labor relations and production cost records. Established company engaged in civilian and defense products. Reply Box 1111, Modern Plastics.

MISCELLANEOUS

AVAILABLE AT ONCE: Plant Superintendent or equivalent with 14 years experience in injection molding of Thermoplastic and Thermosetting materials. Thoroughly familiar with tool and die design and all phases of plant operation. Will locate anywhere. Reply 994, Modern Plastics.

MOLDER WANTED: who can supply material for long run production jobs. Molds available immediately for polystyrene work. Standard plastic colors and formulas required. Reply Box 982, Modern Plastics.

DESIGN ENGINEER—Plastics, Metal—Able to follow through from product development, cost estimate, model, design of injection molds, tools & dies, to setup of production line—Also design of fully automatic machinery for all phases of sheet processing—Extensive experience as supervisor of machine shop—Executive ability—Position in New York City preferred. Reply Box 1100, Modern Plastics.

VINYL SCRAP: Buy and Sell—Film-Sheeting, Slabs—Pan Drippings—Banbury—Shots—Bleeder Stock—All Colors—Any Quantities. CONTINENTAL LACQUER CO. 495 Flushing Ave., Bklyn 5, N. Y.

FOR SALE—NOVELTY GIFT MOLDS: 6 injection molds, good condition; to make plastic letter opener, ruler, pencil sharpener etc. Sacrifice fraction of cost. Weinman Bros. Inc., 3260 W. Grand Ave., Chicago 51, Ill.

TOY HELICOPTER MOLD FOR SALE: One brand-new mold (used only for sample shots) producing a Toy Helicopter whose top propeller revolves when helicopter is pulled along the ground. Mold suitable for 8 oz. machine produces parts for 3 complete units. This is a really attractive toy, and the mold is for sale only for personal reasons. Reply Box 1106, Modern Plastics.

CAPITAL PLUS SERVICES

Executive, 36, graduate engineer with 15 years of manufacturing, merchandising and product development and design experience in plastics and metals fields desires to purchase 50% or 100% interest in established, profitably operated plastics company or merchandising concern. Must be eastern U.S. Ample capital. Would participate actively. Reply Box 993, Modern Plastics.

INVENTIONS WANTED: First-class manufacturer wants inventions using plastics and steel. We can build the molds and dies, run the production, and sell your product. Also interested in buying established businesses. Will pay royalty on existing manufacturing items that we can manufacture and sell. Write Albert E. Payne, Owner-Manager, The Payne Tool and Engr. Co., Springfield, Ohio. Strictly Confidential.

ATTENTION MANUFACTURERS! DO YOU WANT REPRESENTATION IN CANADA? Successful Canadian importers with Dominion-wide following among jobbers, chains, and department stores require additional lines. We will import unit items or use our modern assembly facilities. Aggressive, intelligent promotion of worthwhile products assured. Write: M.B. Industries, 1373 Portage Ave., Winnipeg, Manitoba, Canada.

Merchandising Plastic Products to Jobbers, Chain, department stores, and better retail dealers. Complete Coverage on a local national basis. Representations solicited. Samuel Steele, Distributors, Inc. 14 West 23rd St., N.Y. 10, N.Y.

Important French concern treating all plastic materials (by injection, molding or coating) for industrial users wishes to acquire licences for France or West Europe of new patented processes against payment by royalties. Please write to Dorland, Box 1113, Modern Plastics.

European Concern plans to invest up to one and a half million dollars in plant for production of Plastic Containers for packaging drugs. Wants to acquire methods, patents, machinery, etc. Interested parties write to New Business Developments, 840 Broadway, New York 3, N.Y.

ATTENTION MANUFACTURERS! LINES WANTED: Plastic items for national distribution to the office supply trade. Petite Plastics Company, P. O. Box 816, Greensboro, N. C.

FLORIDA, SO. CAROLINA, GEORGIA are thoroughly and aggressively covered by experienced three-man sales organization now in position to take on a few additional lines. Plastic items, toys, electrical goods, etc. especially are sought, but you will find us versatile. Can warehouse goods. Hope & Co., Chamber of Commerce Bldg., Miami, Fla.

from start to finish... "CUBEE" TAKES COMPLETE CONTROL OF YOUR PLASTICS PROBLEMS

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Five of the key people here have a total of more than 75 years of experience in this business — and remember, this is a relatively new field. That's a lot of know-how — and it's yours for the asking. Let "Cubee" take over *your* plastics problems — from Start to Finish.

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"Cubee solves your plastics
puzzle,
And he does it in a hurry
Just toss the job in
Cubee's lap
And eliminate a worry."

Quinn-Berry Corp.

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PLASTICS

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Phone—Townsend 8-2577	Phone—Greenfield 6-7161	Phone—Hillside 2415-M	Phone—Hilltop 7-0

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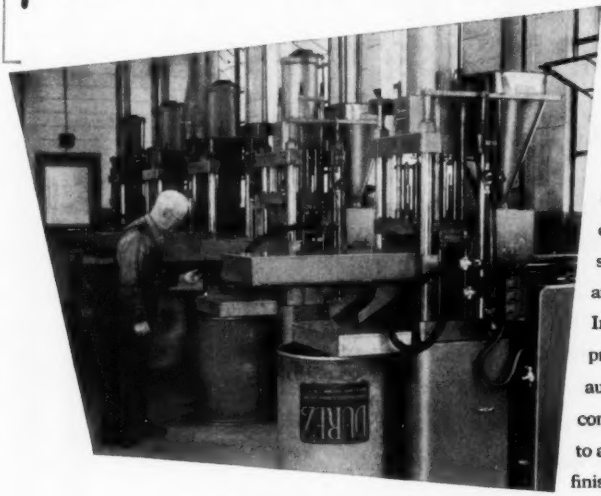
MODERN PLASTICS

575 MADISON AVENUE • NEW YORK 22, N.Y.

Automatic Molding makes more parts per man-hour

Harcort Manufacturing Company of Ravenna, Ohio, makes plastic parts for famous Evenflo Nursers on ten Stokes fully automatic presses producing 15,000 parts per hour.

Products which can be made of plastic materials should be considered for their adaptability to manufacture by fully automatic molding.



Parts molded on fully automatic presses are identical and perfect because time, temperature and pressure are precisely and automatically controlled. Material savings are substantial because material is accurately and automatically metered to the molds. Investment is low because automatic presses are self-contained, requiring no costly auxiliaries. Inventories can be accurately controlled by gaging machine capacity precisely to assembly needs. Labor cost-per-piece of finished product is reduced to the vanishing-point because only one operator is required to handle a dozen or more presses.

Let Stokes experts judge from parts or blueprints if your products qualify for the high production and low labor cost of fully automatic plastics molding. Or write for a 24-page brochure on Fully Automatic Molding.

STOKES MAKES
Plastics Molding Presses,
Industrial Tabletting
and Powder Metal Presses,
Pharmaceutical Equipment,
Vacuum Processing Equipment,
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STOKES

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